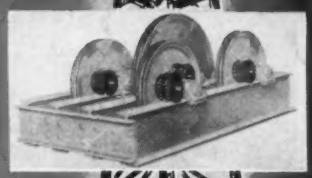
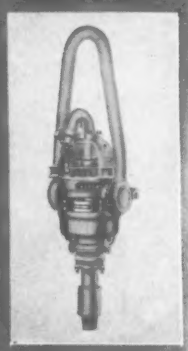
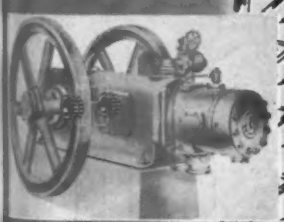
the OIL AND GAS JOURNAL

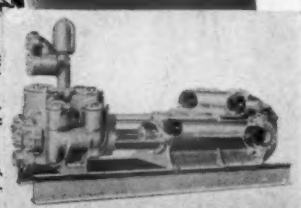
From Derrick Crown to Derrick Floor

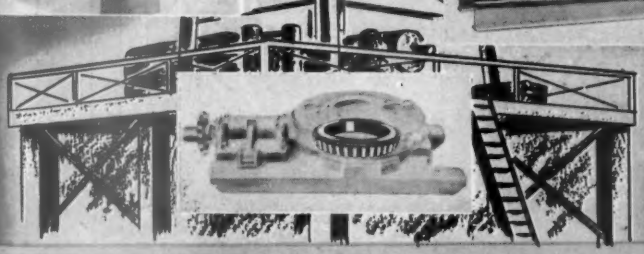
Timken Bearings keep things moving











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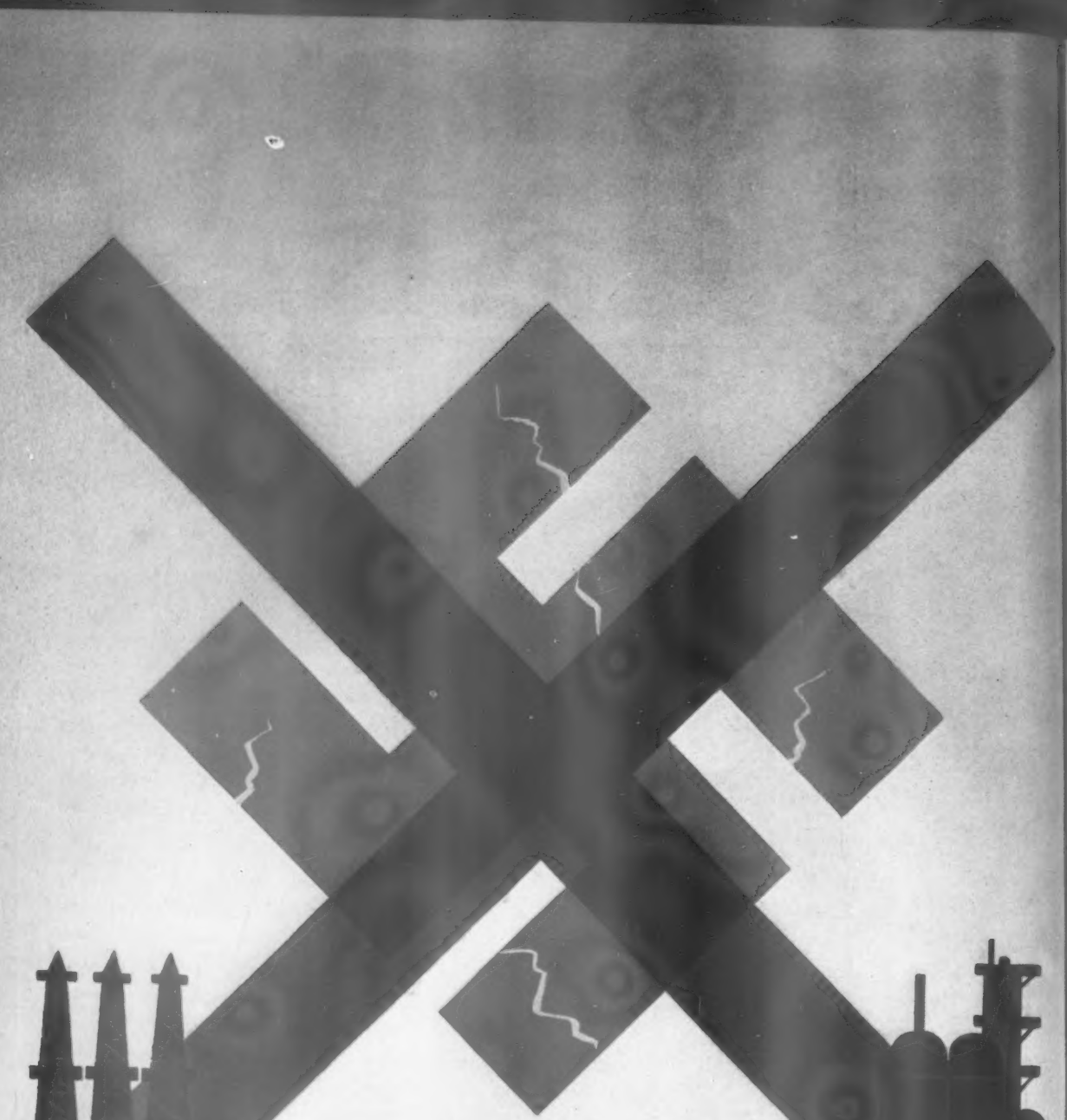

HISTORY LESSON

If we have learned anything from this war, it is this: Ideology may start a war but it takes oil to win it. America's war-time production record (1,685,000,000 barrels in 1944) is due not to natural resources alone, but also to the skill, resourcefulness and methods of men who know how to *make the most* of their resources.

HALLIBURTON OIL WELL CEMENTING CO.

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL

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Quimby Pumps

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Trends

Crude-Oil Production
By States—Page 148

CRUDE-OIL STOCKS 221,552,000 bbl. as of June 9—down 2,527,000 bbl. One year ago 231,290,000 bbl.

GASOLINE STOCKS 87,896,000 bbl. as of June 9—down 800,000 bbl. One year ago 86,298,000 bbl.

RESIDUAL FUEL-OIL STOCKS 38,996,000 bbl. as of June 9—down 26,000 bbl. One year ago 51,946,000 bbl.

GAS OIL AND DISTILLATE STOCKS 30,339,000 bbl. as of June 9—up 520,000 bbl. One year ago 33,617,000 bbl.

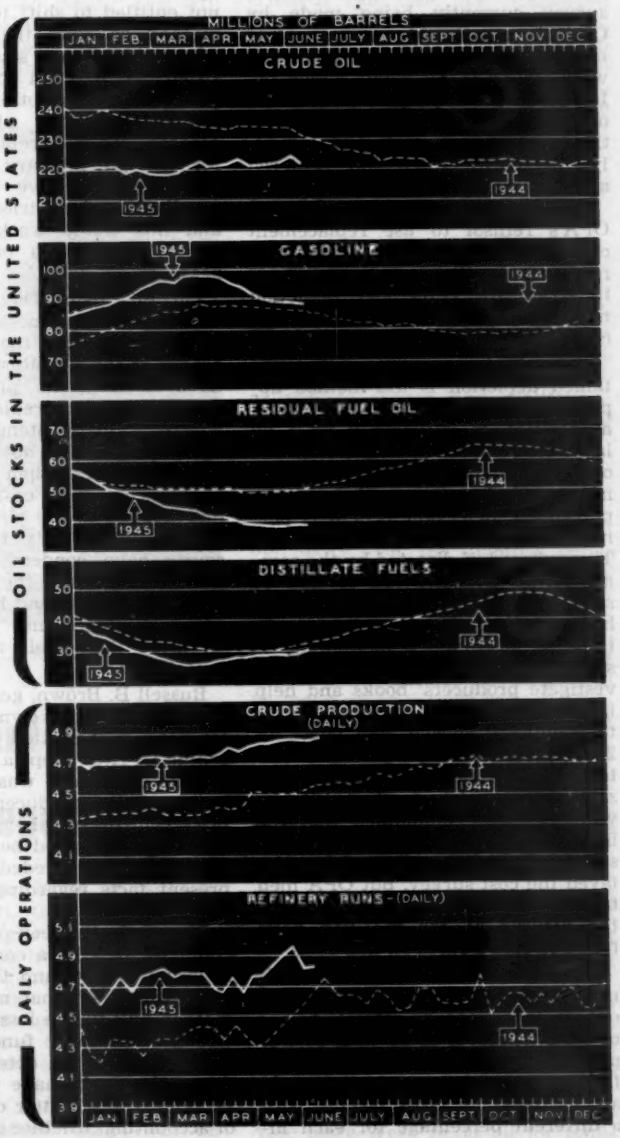
CRUDE-OIL PRODUCTION 4,882,250 bbl. as of June 16—up 31,200 bbl. One year ago 4,568,900 bbl.

REFINERY RUNS 4,827,000 bbl. daily week ended June 9—up 23,000 bbl. One year ago 4,663,000 bbl.

NEW records last week in crude-oil production and in well completions are counter to impressions gathered from discussions with oil men from widely scattered parts of the country. Consensus is that drilling activity is slackening somewhat. Earliest reports indicated that the decline was chiefly apparent in Texas and other states composing District 3, Petroleum Administration for War. More recently, however, so-called "first reports" have diminished in PAW District 2. Any decline in the rate of new wells starting, of course, will not be reflected in completion records for 60 to 90 days.

UNEXPLAINED so far by PAW officials and key executives in the industry is why drilling activity should turn downward. The shift of emphasis away from producing operations in fields most accessible to eastern transportation facilities is a departure from the established pattern of crude-oil quotas, to be sure. But there is no general reduction in the volume of petroleum required to meet military and civilian demands. The complete lineup of production quotas for July is not yet available, but in two key states, Texas and California, next month's crude-oil allocations are either unchanged or increased over the June assignments. Texas and California have been asked to produce a combined total of 3,345,900 bbl. daily of all liquid petroleum products in July, which is nearly 65 per cent of the highest rate of yield in history. With California increased substantially and Texas unchanged, there can be relatively little variation in the quotas assigned other producing states. Therefore, it is obvious that any decline in drilling must be predicated on the fear that PAW assertions of unchanged demand is too optimistic, that the Pacific war will terminate suddenly, or that the general psychology of temporary postwar retrenchment is already influencing oil operators.

THE fact remains, however, that PAW's goal of 27,000 wells for 1945 is based on the soundest factors possible to examine in a wartime economy. Few will argue with the military estimates that a minimum of 18 months will be required to beat Japan into surrender. Neither is it practical or wise to discount the forecast of completion requirements until something more specific than impressions arise to indicate diminishment of domestic petroleum demand.



OPA Accounting Methods in Crude-Price Study Win Approval

by Henry D. Ralph

WASHINGTON. — The investigation proposed by the House committee on small business into reasons why the Office of Price Administration has delayed increasing ceiling prices on crude petroleum turned into a technical discussion of accounting methods and ended with the committee apparently satisfied that OPA is using "recognized methods of accounting" as directed by law.

Charges that the crude oil cost survey currently being made by OPA is not based on accounting methods used by small producers were among many points which the Independent Petroleum Association of America sought to have aired at the hearings last week, but virtually the entire discussion centered around this single point.

Chief complaints were against OPA's refusal to use replacement cost of new oil as the basis for current price ceilings and its refusal to accept the percentage depletion method instead of the sustained or cost depletion method.

OPA officials maintained that sustained depletion is the method approved by all recognized accounting authorities, is universally used by large oil companies, and is required of small companies by internal revenue regulations even though the percentage depletion system is permitted in figuring income taxes. They offered, if directed by the committee, to examine tax returns of small producers to see how many had complied with the requirements to show sustained depletion, or to send their field accountants to investigate producers' books and help them set up records on this basis, or to conduct a special spot check of 200 representative producers to determine how many understand the sustained depletion method. I.P.A.A. witnesses had complained that the inability of small producers to show sustained depletion figures has delayed the cost survey, but OPA men told the committee that only six of the returns so far received have failed to give figures on this basis.

Paul M. Green, deputy OPA administrator for accounting, pointed out that percentage depletion has nothing whatever to do with cost of production but is a special tax benefit for natural-resource industries and is based on gross income with a different percentage for each industry. Under this method, he said, oil producers could easily recover more than total costs, which obviously makes percentage depletion not a cost accounting system. He said that the Bureau of Internal Revenue informed him that 95 per cent of oil producers do report sustained depletion figures although basing their taxes on percentage depletion.

The so-called "last in first out" method of valuing inventory is recognized by OPA but companies are not entitled to shift to or from this method as suits their momentary advantage, Green said, and he insisted that it is not applicable to oil pricing and has nothing to do with replacement costs of natural resources. To use replacement costs for the oil industry would mean that it would have to be applied to all other industries, Green said, and this would work hardship on many other types of small business.

On this point David F. Cavers, OPA assistant general counsel for price, pointed out that the refining branch of the oil industry would also have to have its prices adjusted on the basis of replacement costs and that many items of refining equipment could not now be replaced for less than 50 per cent above what they cost when originally installed. He also said that in many public utility rate cases the courts have condemned using replacement costs as the basis for fixing current rates and have said that investors should not get a return on more than their actual capital investment.

Russell B. Brown, general counsel, and James V. Brown, accountant, for I.P.A.A., admitted that they are asking OPA to adopt a cost accounting method which was not used by independent producers prior to price control, but they said no such method was needed before and that some system is needed to show the present facts regarding the cost of producing oil.

They asked Green what method could be used by a company which is losing money, and Green replied with some heat that no accounting method will turn a loss into a profit and that the only function of cost accounting is to determine facts. After the facts have been found, he said, it is a matter of policy, not of accounting, whether or not a price increase is granted, and he accused the I.P.A.A. of trying to use accounting as a device to obtain higher prices and to "sell" OPA on a new method which will show the desired results.

Following this exchange Rep. Leonard W. Hall of New York declared that there is no question in his mind that OPA is following recognized accounting practices.

Summarizing OPA's position, Orville D. Judd, fuel price executive, said that this accounting situation was the basis of his statement at the beginning of the cost survey to the effect that OPA would not base price ceilings on replacement costs, and he deplored the fact that this statement was criticized as "prejudging" the issue before the survey was completed.

House Favors Intangible Drilling Cost Deduction

WASHINGTON.—The House ways and means committee has favorably reported House Concurrent Resolution 50 introduced by Chairman Robert N. Doughton declaring the intent of Congress to give legal effect to internal revenue regulations permitting oil operators to deduct intangible drilling costs as current operating expenses for tax purposes.

The legality of these regulations was recently challenged by the Fifth Circuit Court of Appeals in the case of the F.H.E. Oil Co. The Treasury Department endorsed the resolution on the ground that its regulations have carried out the intent of the law, but it again stated its opinion that the law should be changed to require that intangible drilling and development costs be capitalized for tax purposes. This same position has been taken by the Treasury during the last several revisions of the internal revenue laws but has never been accepted by Congress.

The resolution now goes to the Senate for action.

Georgia Plans to Establish Conservation Measures

WAYCROSS, Ga. — Georgia State Oil and Gas Commission, created by the legislature and approved by Gov. Ellis Arnall, was organized here last week, with George M. Bazemore, Waycross banker, as chairman, and C. D. Deming, ex-officio secretary and director of conservation.

"We are studying all the oil and gas conservation rules now in effect," said Bazemore, "and Deming will study these regulations, note the best of them, and will recommend measures suitable for Georgia."

Journal Editor to Report on Oil Activities in Middle East Area

THE Oil and Gas Journal over the next several weeks will give the petroleum industry its first complete report of oil activities of the Middle East. C. O. Willson, editor of the Journal, has flown to Cairo, Egypt, gateway to the vast area which has become of major importance in present and future world petroleum operations. From Cairo, Willson will visit the fields and refineries of Iran, Saudi Arabia, Kuwait, Qatar, Bahrein Island, Syria, and Palestine.

Gaining in importance steadily since World War 1, it is now conceded that the tremendous petroleum reserves of the Middle East will be a controlling factor in petroleum and world economic trends over a prolonged period.

Petroleum Administration for War last year estimated the proven oil reserves of four countries of the Middle East at 15½ billion barrels. There have been new discoveries and extensions since that time and today's reserves in that area are generally estimated substantially in excess of the PAW figure. There are in addition a large number of promising structures scattered over a wide area in the Middle East which have not been tested.

Large-scale additions to Middle East operations have been completed during the war period or are under way at this time. It is planned to double or triple the present pipeline capacity of Iraq in the postwar period. A big-inch line from the fields of Arabia to the Eastern Mediterranean has been widely discussed over the past 2 years and is also a postwar prospect. The refinery on Bahrein Island was recently expanded to a war-product plant with a capacity in excess of 60,000 bbl. daily and another large major refinery is under construction on the adjoining mainland of Saudi Arabia.

These and other developments in the making with factual information on operating practices already established will be brought to Journal readers as quickly as data are obtained and cleared in accordance with war regulations. The reports will include interpretative articles revealing the part that the additional oil supplies of the Middle East will play in the rehabilitation of the Eastern Hemisphere and the postwar adjustments applying to the entire oil world.

C. O. WILLSON

Committee Told Government Has No Claim to Coastal Oil Deposits

WASHINGTON.—The federal Government has no shadow of a claim to coastal oil deposits off California or Texas nor to any submerged lands in or adjoining the boundaries of any state, the House judiciary committee was told this week by representatives of the attorneys general of 46 states.

The witnesses strongly endorsed a block of 18 similar resolutions pending in Congress which expressly reaffirm the title of the states in all submerged lands. Necessity for the legislation, they said, are the recent statements of Interior Secretary Ickes that he intends to grant federal drilling permits in oil fields off the California coast already being developed under state leases, and the action of the Department of Justice in filing suit to enjoin Pacific Western Oil Corp. from operating under a California drilling permit. The Supreme Court will unquestionably reaffirm state title to submerged lands, they asserted, but meanwhile these actions by federal officials have thrown a cloud on the titles to all submerged lands which may seriously affect development of port facilities, fisheries, land reclamation, and other shore activities.

Chief spokesmen were Robert W. Kenny, attorney general of California; Grover Sellers, attorney general of Texas, and Leander I. Shelley, counsel for American Association of Port Authorities. They filed a brief in support of the legislation signed by the attorneys general of 46 states.

Citing many court decisions and other legal authorities, the witnesses maintained that there never has been the slightest question about state title to submerged lands until 1937 when certain federal officials raised the point. If the federal Government can take one submerged oil field in California, they agreed, it can obtain ownership of coastal and tide lands, the beds of all freshwater lakes and rivers, and all reclaimed and made lands, with any structures on them, in all states.

Sustained High Production Needed

WASHINGTON. — Sustained high demand for crude oil in July was assured this week with Petroleum Administration for War allocations to Texas and California, pending final tabulation of quotas for other producing states.

A production rate of 1,012,900 bbl. daily of all petroleum liquids is certified for California next month, representing an increase of 5,700 bbl. daily over the quantity certified for production this month. July will be the third consecutive month that the 1,000,000-bbl. mark has been exceeded for California.

The certified production rate of all petroleum liquids for July is to be made up of 952,000 bbl. of crude oil and 60,900 bbl. daily of natural gasoline and condensate. These figures represent increases of 5,000 bbl. daily in crude oil and 700 bbl. per day in natural gasoline and condensate compared to June. The crude-oil production rate for California is fixed at a figure 23,500 bbl. above the maximum efficient rate which PAW explained was mandatory because output must be maintained at maximum levels to supply West Coast refineries.

The July allocation to Texas calls for 2,333,000 bbl. daily of all petroleum liquids, the same figures prevailing in June. Emphasis has shifted from sweet crude in East Texas and Gulf Coast fields to provide more West Texas oil for tank-car shipment to California.

Pew Scores Idea of Creating National Petroleum Reserve

WASHINGTON.—Proposals to conserve known resources of crude oil in this country by restricting the use of petroleum to so-called more essential uses or by prohibiting drilling in large areas set aside as national defense reserves, had they been adopted years ago, would have found the United States completely unable to supply the oil needed to fight the present war, the Senate oil investigating committee was told by J. Edgar Pew, vice president of the Sun Oil Co.

Instead, by fostering free competitive enterprise, we have discovered and developed our oil resources to a greater extent than any other nation, have supplied the bulk of the oil needed by the Allies, and now have the largest volume of proved reserves in history in spite of huge war consumption, said Pew in opening a series of hearings on the general subject of liquid fuel resources.

Ridiculing predictions that America faces an oil famine, Pew, who is chairman of the American Petroleum Institute committee on reserves, likened proved reserves to a raw material working inventory or stock pile which is constantly being replenished and increased in size. Periodic predictions of the past 70 years that we would soon run out of oil have proved false because demand and price are the regulators of production and competitive enterprise has always found more oil and improved technological processes for production and utilization, he declared.

This process will go on if the price of oil is high enough to make it commercially feasible, but neither government edict nor wishful thinking can force such developments, he declared. Pew predicted that with higher prices for crude large potential producing areas as yet largely unexplored will be developed, older fields will be extended, more complete recovery methods will be used, more efficient refinery techniques will be employed, automotive engines and heating plants will become more efficient, and industry will be encouraged to develop synthetic fuels from gas, shale and coal. Furthermore, he added, the increased utilization will mean that products prices to consumers will not increase greatly, such a program of unhampered commercial development will be far greater assurance of a fuel supply in case of another national emergency than any plan of hoarding reserves in the ground which might be imposed by the Government, Pew told the committee.

Pew expressed the opinion that naval reserves have little or no value for future national defense, and that production from them has been of no strategic benefit to the Navy during this war. Developing the Alaskan field at Point Barrow would cost billions of dollars and, on the basis of the Army's Canol experience, probably would not be justified. The nation's resources belong to the Army and Navy in time of emergency, Pew said.

On the basis of Pew's testimony, Senator O'Mahoney said, it would appear that there is ample oil in reserve in this country to meet all national defense needs and all or nearly all industrial demand for at least the next 20 years.

Confirming this, M. G. Cheney, president of the American Association of Petroleum Geologists, told the committee that fully half of the continental United States overlies marine sediments, favorable to the discovery of oil. War conditions have retarded research and discovery, Cheney said, and in prewar years economic limitations rather than lack of prospective territory held back exploration efforts. With over-supply and comparatively adverse pricing in the '30s, Cheney said, it seems unbelievable that the industry, with only 1,000 to 2,000 drilling rigs and less than 5,000 geologists and geophysicists engaged in exploration, met requirements and also built up an under ground stockpile sufficient to meet unprecedented wartime demands. Even under recent shortages, discoveries, extensions and revisions have equaled production.

Hearings continued throughout the week, with the industry's presentation under the direction of J. M. Lovejoy, president of Seaboard Oil Co. of Delaware, and including testimony on resources from E. L. DeGolyer, consulting engineer, and other witnesses.

Later hearings in the series, O'Mahoney said, will bring the Anglo-American oil treaty and other foreign aspects of American petroleum policy under scrutiny.

Bohart to Become PAW Director of Production

Phil H. Bohart, Tulsa, assistant to the vice president, Gulf Oil Corp., soon will become director of production, Petroleum Administration for War. He will succeed J. R. McWilliams who has served as director of production for PAW at Washington since the middle of 1944.

McWilliams will return to Tulsa as vice president of The Carter Oil Co. in charge of production. When he accepted appointment to the PAW staff, McWilliams was manager of Carter producing operations in the Rocky Mountain district with headquarters at Billings, Mont.

Colonel Thompson Returns To Commission Duties

Col. E. O. Thompson, member of the Texas Railroad Commission, has returned to Austin and will soon receive formal orders returning him to inactive duty. He recently completed a 60-day special assignment in the Army during which he conducted an analytical survey of petroleum transport and storage methods and facilities between Normandy and the Rhine. Objective was to select the most efficient services for transfer and adaptation to the Pacific campaign.

State Department Confirms Argentine Oil Agreement

WASHINGTON. — Acting Secretary of State Joseph Grew has issued a statement confirming the conclusion of an agreement under which Argentina is to receive fuel oil in exchange for vegetable oils. The latter will be made available to liberated areas in Europe. The fuel oil will be from Caribbean sources, it was stated, and Argentina is to get the equivalent in heat content to the vegetable oils she formerly burned to meet fuel needs.

No estimate of volumes involved was given by the State Department, but it is understood the arrangement will provide Argentina with 3,750,000 bbl. of fuel oil this year and the same quantity in 1946, approximately her prewar consumption.

The deal was described as a procurement transaction for the United Nations, which have placed vegetable oils among their major needs.

House Unanimously Approves Resolution 50

WASHINGTON. — The House unanimously passed the Doughton resolution, House Concurrent Resolution 50 affirming the legality of internal revenue regulations which permit intangible drilling costs to be treated as operating expenses.

THIS WEEK

LITIGATION—Government suit to determine ownership of oil under submerged land stirs protests from 46 states. . . . Government called "claim jumper." . . . ¶"Trespass underground" alleged in salt-water disposal case appealed to Oklahoma Supreme Court. . . . Property owners contend pumping water back will injure their land. . . . ¶U. S. Supreme Court agrees to review District Court decision that Champlin's pipe line is common carrier, under jurisdiction of ICC. . . . ¶House committee approves legislation validating deduction of intangible drilling costs for tax purposes. . . .

TRANSPORTATION— SEC approves financial setup by which American Light & Traction Co. plans construction of pipe line from Hugoton field to Detroit. . . . To provide gas for communities served by company's subsidiaries. . . . ¶Engineering begun on 620-mile 16-in. line from Kirkuk, in Iraq, to Haifa by Iraq Petroleum Co. . . . Estimated cost $50,000,000. . . . Orders for 120,000 tons pipe placed in England. . . . ¶Texas-Empire announces extension of its system from Southwest to Chicago refining area. . . . Cost $3,500,000.

TIRES— Unprecedented postwar expansion in tire manufacture expected to create soaring demand for carbon black. . . . Estimated 77,500,000 new tires for U. S. alone will be needed first year automobile manufacture gets under way. . . . ¶Cutbacks in military requirements for tires eases carbon-black demand temporarily, but WPB continues clamp on civilian rubber products. . . . ¶Tire plants take advantage of breathing spell to repair overworked machinery. . . .

NATURAL GAS— Railroad Commissioner Jester says campaign to change his mind regarding exportation of gas from Texas is futile. . . . Will have to show first "that our reserves will warrant it." . . . ¶Commission's director of production says Texas natural-gas supply, at current production rates, will last 25 years without adding new reserves. . . .

REFINING—OPA committee contends vigorously for higher refinery prices if crude prices are advanced. . . . Condemns proposed subsidy for refiners. . . . ¶Minnesota imposes 4-cent tax on aviation gasoline. . . . ¶Nation's civilians to get 1,404,000 bbl. of gasoline daily throughout third quarter. . . . Addition of 140,000 daily available from June 22 to meet increases in A-card values and B-card ceilings. . . . ¶PAW estimates strikes in one field and five refineries caused loss of 3,000,000 bbl. oil products. . . .

PRODUCTION—PAW asks 10,000 bbl. daily increase in West Texas sour-crude output. . . . Yields heavy cut of needed fuel oil. . . . Will be shipped to West Coast refineries. . . . ¶Fifty-eight wells in East Texas plugged during April. . . . Total of 24,395 remain in field. . . . ¶New high in nation's completions—586. . . . Previous high last December, 563. . . . ¶National daily crude production 4,882,250 bbl. . . . All-time peak. . . . Exceeds previous record, made last month, by 14,200. . . . Kansas, up 25,100 bbl., and California, up 6,900, principal contributors to gain. . . .

FOREIGN— New Jersey Standard files claims with State Department for war damage to European properties. . . . May file with European governments also. . . . ¶Mexico seeks to increase oil production 10,000,000 bbl. this year. . . . Program calls for 72 new wells. . . . ¶Agreement of U. S. to supply Argentina with fuel oil in exchange for vegetable oils officially confirmed . . .

Acme

This gravity-feed fuel dump was built by the Seabees on Guadalcanal below a roadbed. Trucks fill the tanks from the road above, and gravity does the rest

States Urged to Vitalize Policies In Natural-Gas Conservation

by H. Stanley Norman

OKLAHOMA CITY.—Gas producing states were urged here June 14, 15 and 16 to take immediate steps to thwart threatened extension of federal regulation over every aspect of the natural-gas industry. States were advised to enact legislation and establish enforcement procedures which will bring about sound conservation practices. This advice contained in a resolution adopted by the executive committee was offered as the "best insurance against intervention on the part of the federal government in matters of production and gathering" which the commission asserted is "the exclusive function of the sovereign states."

A slightly abridged summary of E. L. DeGolyer's paper on proven natural-gas reserves, starting on this page, was the feature presentation before the summer quarterly meeting of the Interstate Oil Compact Commission in Oklahoma City last week. His summary will be presented in more detail later this month before the O'Mahoney committee in Washington. No action was taken on selecting meeting place or date for the fall quarterly meeting, pending developments in the transportation situation. Many executive committee members, however, favored continuation of the natural-gas deliberations at the next meeting either in September or December.

The paper by E. L. DeGolyer, Dallas, on proven natural-gas reserves which attracted a capacity audience, failed to provoke anticipated floor discussions, despite efforts of Gov. Andrew F. Schoeppel of Kansas, chairman of the compact. The author stressed the force of economics in furthering gas conservation. He urged free interstate movement of natural gas which is a stand previously opposed by the Louisiana delegation to the compact meeting. Sam H. Jones, former governor of Louisiana, declared at the opening compact session that his state is opposed to expanding exportation of natural gas and that it preferred to maintain fuel resources within its borders rather than become a coal importer in future years.

If the trend of recent United States Supreme Court decisions affecting the natural gas industry continues unchecked, the Federal Power Commission will eventually become "master of the field and arbiter of price" at the well-head, Carl I. Wheat, Washington, attorney for the Independent Natural Gas Association of America, told the commission.

"In my opinion any practice on the part of the FPC which consists merely in reducing rates for gas sold by a certain few pipe lines, through seizing upon the fact that they may enjoy lower than average production costs in the gas fields . . . cannot fail in the end to prove highly inimical to the principles of true conservation," Wheat said.

These practices, he continued, "cannot fail to hamper the states both as to conservation and as to their taxing powers, and cannot fail to harm the underlying interests of royalty holders and all other persons in the producing states."

After pointing out that a legislative prohibition exists against federal regulation of production and gathering of gas, Wheat asserted that "it seems clear that the Canadian River Gas Co. decision does not in any sense constitute the last judicial word we are to hear on this subject."

In a paper prepared by Charles V. Shannon, general counsel for the FPC and read by A. A. Hammer, Fort Worth, an FPC engineer, he sought to allay the fears of the states that his agency was encroaching upon state authority.

"Not only is the commission's rate-making authority limited to transportation and sale of natural gas for resale in interstate commerce, but Congress specifically provided in the Natural Gas Act that the commission shall not have jurisdiction over 'the production and gathering of natural gas'," he emphasized.

Prices paid to the producers cannot be reached by the long arm of the commission, he continued, but the commission has allowed such prices and costs as operating expenses of the pipe-line company.

"However, the gas which the pipeline company produces, is not sold until it reaches the 'city gate' and the price which is charged at that point represents the interstate wholesale rate to be regulated by the commission under the act," he asserted.

"Faced with a determination of the just and reasonable rates to be charged by the pipe-line company for gas which it produces, the commission has taken it for granted up to now that it should see to it that the company secures full reimbursement for all the costs, including a fair profit, it incurs in the process of acquiring and developing an adequate gas supply."

Richard B. McEntire, Topeka, chairman of the Kansas Corporation Commission, and member of a panel discussing Supreme Court decisions, declared the FPC's action in establishing a rate system based on the cost of production, plus a profit, as "economically unsound" and as "an opening wedge for general control of the whole industry."

The Nation's Reserves Of Natural Gas

by E. DeGolyer*

AS a nation, we are becoming increasingly conscious of the great importance of our natural-gas reserve. We have long recognized natural gas as the most convenient and economical of fuels but we now appear to be on the threshold of prizing it as an important raw material from which much of the motor fuel of the future will be made. It now appears that the time is not far distant when 10,000 cu. ft. of gas may be regarded as a potential barrel of gasoline. Conservation of gas is a matter requiring immediate and serious attention and the time when more than a billion cubic feet of gas daily can be flared or wasted is past.

*DeGolyer & MacNaughton.

My firm has just completed, as of the first of this year, a survey of the oil and gas fields of the nation with particular reference to gas reserves. We find that the United States has a proved gas reserve in excess of 140 trillion cubic feet. Of this quantity, 9 per cent is solution gas and the remainder is gas cap or free gas. This estimate is only for those fields which contain 20 or more billion cubic feet. The reserves have been calculated on a pressure base of 16.4 psi. and 60° F. temperature.

Of the estimated reserves, 5 trillion cubic feet are located in District 1, about 17 trillion are in District 2, just short of 104 trillion in

District 3, over 2 trillion in District 4, and approximately 13 trillion in District 5. Texas possesses reserves in excess of 82 trillion cubic feet.

Total production of natural gas during 1944, including gas flared or wasted, is estimated at 4 trillion cubic feet. Thus the presently proved reserves are equivalent to 35 times the estimated 1944 withdrawals. This ratio in itself means little but it is almost twice as good as the corresponding oil reserves — yearly oil consumption ratio. My judgment is that the proved reserves of gas are satisfactory enough to allow of their being freely produced but only under best conservation practice.

The profit incentive is what the producer lacks today. Very few wildcat wells are drilled for the purpose of finding additional gas reserves. The reason is obvious. In most areas, additional gas reserves, and I refer particularly to the Mid-Continent and southern regions, would further glut the market. Present gas reserves in some areas are looked upon as frozen assets—or liabilities. If a market for newly discovered gas is available, it is usually limited and the payout time on money invested makes the project commercially unattractive.

An outstanding illustration of this is the discovery well of what is now one of the major gas reserves in the Gulf Coast area. Here a company completed a good gas well in the center of a large block of acreage but because gas alone was not considered attractive enough commercially the acreage was relinquished for a very small override.

A Common History

It is only because oil and gas have a common history that the nation's proved gas reserves are so tremendous today. Oil and gas are intimately related. They are produced from the same sources, are accumulated by similar agencies, and include in their chemical composition many of the same components. They are found in the same type of reservoirs. As a general rule, these are of three types: (a) reservoirs in which the only contained hydrocarbon under subsurface pressure and temperature is oil; (b) pools in which the hydrocarbon content is wholly in the gaseous phase; and (c) pools containing the combination of these two, that is, a gas cap underlain by oil.

It is common knowledge that deeper drilling has resulted in finding the natural hydrocarbons increasingly in the gaseous phase and it is only reasonable to expect that this trend will continue and that, with increasing depth, the proportion of gas discovered to that of oil will be increasingly greater. Furthermore, as more wells are carried to greater depths, higher reservoir pressures will be encountered. If only oil is present within these pools, it is likely to be charged with gas to a greater degree per unit volume that the oil contained in shallower reservoirs. If only gas is present, it also will be under higher pressure and the porous strata, per unit volume, at least, will contain more gas. To illustrate, a unit volume of pay zone under normal conditions at 10,000 ft. contains 1.76 times the amount of gas contained in a similar unit volume of zone at a depth of 5,000 ft.

With the above knowledge at hand and with the search for oil in the United tates at an all-time high and expected to increase both in area and in depth as the material and manpower become available, there can be no reasonable doubt that additional gas reserves will be found in quantities more than sufficient for present needs.

This brings us to our next points: markets and expansion of markets. Those long in the oil industry will remember that there have been recurrent alarms that our oil resources would be exhausted soon. Conservation is now being invoked for what seems to be ulterior motives. Ears willing to listen are being filled with the story that the reserves of gas are not sufficient to justify the construction of new transmission lines or expansion of present facilities. Nothing is further from the truth. Gas reserves are at an all-time high. Additional gas to bolster the presently proved reserves is not problematical nor probable. It will be actuality if the profit incentive to open new pools can be quickened.

What is the basic reason for a stagnate condition in an industry concerned wholly with a natural resource which is admittedly an ideal fuel? Can it be the manner of regulation of the transportation?

Transportation of all commodities across state lines, including oil carried by pipe lines, comes under the jurisdiction and regulation of the Interstate Commerce Commission. No, I am wrong in the foregoing statement. I said all commodities but I should have exempted natural gas. Why? I do not know but it is ridiculous that this prime fuel should be singled out for special treatment or consideration, as has been done. However ridiculous, it is not the whole story of the manner in which the natural-gas industry has been mauled around. Obstructionist activities have continued unabated to the end that regulations are now being contemplated which would control the end use to which gas could be put. This despite the fact that in the Tennessee case in 1943, as well as in an official report to Congress in January 1944, the regulatory body, to which all interstate natural-gas transporters must look, disclaimed any authority to restrict or delimit the end uses to which natural gas could be put.

However, in the face of this I find in a letter written by the chairman of the Federal Power Commission to the chairman of this Interstate Oil Compact Commission the following paragraphs, and I quote:

> "The immediate occasion for the institution by the commission of its investigation is that, in proceedings relating to the issuance of certificates of public convenience and necessity for natural-gas pipe lines, intervenors, including representatives of certain gas-producing states, have contended that the commission is authorized and, under the provisions of the Natural Gas Act, should promote the conservation of natural gas by limiting or prohibiting its transportation and sale for certain so-called inferior end uses, such as boiler fuel. It has also been urged that the commission should deny certificates to take natural gas from states desiring to retain or utilize such gas within their own borders. With equal earnestness others insist that no restrictions should be placed upon the interstate transmission and sale of natural gas.
>
> "In dealing with these conflicting contentions in individual cases it has become clear that the commission does not have sufficient information to formulate a definite policy on its own part or to submit clear-cut recommendations to the Congress . . ."

Let us do away with this rigmarole. Let the distribution of natural gas within the individual states be a public utility but under the supervision of the proper state regulatory body as the consensus of unbiased, common-sense thinking dictates. Let the regulation of transportation of natural gas across state lines from the producing areas to the markets be treated with the same respect and consideration as is accorded other interstate traffic of natural resources. Finally, let us see that the regulations for the production of natural gas within the individual states are placed as contemplated by the Constitution of the United States; that is, under the absolute jurisdiction of the proper regulatory agencies of the individual states.

The jurisdiction of federal agencies having to do with the interstate transportation of gas, or any other natural resource, should be precisely defined. In my opinion, no federal agency should attempt to accomplish indirectly that which they cannot do directly.

The natural gas industry is made up of three distinct phases: production, transportation, and distribution. At present, because gas is transported across state lines, FPC could reach forward to regulate distribution and backward to control the production of gas prior to its delivery to an interstate carrier. This is presuming that FPC wished to

stoop to control indirectly that which it could not control directly.

Not only this, but I find that in the establishment of some rates for gas sales no provision has been made to enable certain integrated gas companies to increase reserves or pay lease rentals on proved non-producing or wildcat acreage.

Rather than obstruct or aid in the obstruction of the expansion of gas markets, supply, and the finding and developing of additional supplies of natural gas, all federal agencies and all the state regulatory bodies should aid the natural-gas producers to get all available natural gas into pipe lines so as to increase the natural wealth of the individual states and the nation as a whole.

Adequate Price and Conservation

May I suggest, at this point, that adequate price is the greatest conserving agent in the world. There is no problem of end use or of conservation which will not be solved—and better solved than can be done by the best of regulations—if the producer can have adequate markets and a decent price.

Because of the rapid growth in the pipe line take, we continually hear that, if the use of natural gas is not restricted, the increasingly greater annual consumption will soon exhaust the gas resources of our nation. Nothing is further from the truth.

To make this clear, consider the Panhandle field, which is one of the largest, if not the largest, single gas reserve known to the world today. During 1934, pipe lines took approximately 165 billion cubic feet of gas from this field. In 1944, the pipe line take was a trifle over 364 billion cubic feet, an increase over the 10-year period of about 120 per cent. But this is not the whole story. While the pipe-line take from the field was steadily increased, casing-head gasoline plants have reduced their take from approximately 632 billion cubic feet to about 1 billion cubic feet, and other gas used in the field was reduced from 24 billion to 16 billion cubic feet. Thus, over-all, the field in 1934 produced 859 billion cubic feet and only 746 billion cubic feet in 1944. In other words, the Panhandle field produced 113 billion cubic feet of gas less during 1944 than it produced during 1934. So much for the statistics of the Panhandle field.

If this were only an isolated case, there the subject would end. But this is only one of the many fields in which gas waste has been curtailed. A few of the others are Old Ocean, Agua Dulce, Chapel Hill in Texas, Erath and Monroe in Louisiana and not the least is the work accomplished in south Arkansas by direct cooperation between the producer and the state regulatory body. Here large quantities of the sourest of sour solution gas, as well as free gas, are now sweetened and then marketed so that the producer, royalty owner, and state are all receiving an additional revenue from what was once a wasted product.

What has brought about such a reduction in the waste of gas in the fields for which markets have been developed? One has only to look half-closely to see the light. Economics! Pipe lines to marketing centers have been constructed and the producer of gas, when he has a market, can plainly see it will pay him to conserve rather than waste gas.

But solution gas in most areas is another matter. Natural gas is contained in oil within the reservoir and, as pressure is reduced either within the reservoir or as the oil is brought to the surface, the gas comes out of solution. The necessity for the proper control, conservation, and use of this solution gas—energy, if you will—in connection with oil production is supposed to be well known and understood. In spite of accepted knowledge, one finds that regulations of various states allow the producer of oil in many fields to produce incidentally as high as 2,000 cu. ft. of gas to 1 bbl. of oil, without penalty. This even though the dissolved gas contained in a barrel of reservoir oil is only in rare cases as much as 1,000 cu. ft. and the general average is between 500 and 600 cu. ft. This is not the worst misconception of conservation. The thought is still held by many that solution gas has accomplished its full natural function when it has performed the work of bringing oil to the surface and that it is the producer's prerogative then to blow it to the air.

An Erroneous Notion

The idea that it is not waste to burn solution gas in oil field flares is fantastic. It is a tremendous waste of a natural resource.

Natural gas is a commodity which must be confined from the time of production to consumption. Field purchase price, fear of the oil producers being classed as a public utility because of his gas entering an interstate pipe line, and the manner in which gas-pipe-line companies conduct their business, are all cited as reasons for the volumes of gas dissipated incidentally to oil production. I believe none of this. What is required is markets for this waste gas as well as markets for the tremendous volume of gas that properly could be produced from the present proved reserves of the country.

Markets for this gas are required so that a demand will be created which will place a value on field gas sufficient to cover the cost of preparation and compression to make the gas suitable and available for pipe-line transmission and give the operator a profit incentive to conserve gas.

Throughout the whole scandalous history of our waste of natural resources, we are too prone to point the finger of blame at the producer. This is just as true of the farmer who raped the soil, the lumberman who slashed the forests, and the miner who high-graded the ore, as it is true of the oil and gas producer who at times has burned in his flares an amount of gas having a greater B.t.u. value than the oil which was saved. We, the people, as consumers must accept the blame for what has happened in the past. Price was the control. Why ask anyone to save a natural resource at a cost as great or greater than the low and inadequate value which the consumer puts upon it?

One has only to look to California for an example of what can be accomplished in the conservation of natural gas by price. There, flares are past history. The reason? Gas in the fields commands prices which range from 6 to as high as 12 cents per thousand cubic feet. As a direct result, it is estimated that less than 1 per cent of the total gas produced in California during 1944 was wasted or flared.

However, let us not be too academic in our consideration of conservation, the single stated object of this Interstate Oil Compact Commission. The greatest conservation factor is not law and regulation. It is not even custom or habit of the industry. It is price. However unpalatable this may be commercially or politically, one must face it.

Subsidy Extended to Three Additional Pools

WASHINGTON. — Three pools have been tentatively designated for stripper-well subsidy payments, effective July 1, the Office of Price Administration announced last week.

Burbank, Kay and Osage counties, Oklahoma, will go in at 35 cents, and Rea, Okmulgee County, Oklahoma, at 35 cents. Olinda (upper B) Breoslinda, Orange County, California, will be added also at 35 cents.

Capitan pool in California, previously designated for payments on production below 3,000 ft. was redesignated as "Capitan, Sespe formation, above 3,000 ft."

Minnesota Taxes Aviation Fuel

ST. PAUL. — Minnesota's legislature has passed a law imposing a tax of 4 cents on gasoline sold and used for aviation purposes, effective June 1.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Remove the Ambiguity

WIDELY separated views of many elements in the natural-gas industry must be consolidated before an acceptable solution is possible to the question of how to eliminate waste. Without helpful cooperation of federal agencies, the industry is powerless to finish the job. Huge strides have been made by the industry and state regulatory officials in reducing waste of gas. But the objectives sought by all will remain beyond reach until certain basic obstacles are removed.

It should be the common purpose of producers, pipe-line companies, and consumers to diminish flaring of natural gas to an irreducible minimum. The incentives certainly are common to all concerned. Then why do flaring and burning of gas persist in some of the nation's great oil fields? Why doesn't the nearest natural-gas pipe-line company gather this gas and apply it to useful work? Why do the crude-oil producers continue flaring instead of returning gas to the reservoir to function again as the agent for lifting additional barrels of petroleum?

The answers seem obviously simple. Yet here is one of the most complex problems imaginable when examined in all its aspects. Economic considerations are exceedingly important. Only cheap gas is wasted, because producers cannot afford facilities to save it. Threatened expansion of Federal Power Commission regulation is hardly less vital. Producers of crude oil utilizing natural gas as the chief force in depleting reservoirs want no part of the FPC regulation as already applied to operations under its jurisdiction. They fear association with interstate gas companies would open the way for FPC interference inimical to their interests.

Nor is the fear of FPC a straw man created by the petroleum and natural-gas industry. Only recently the Supreme Court held in the Canadian River case that FPC was within its authority in setting the price of natural gas at the well head. All this too in the face of specific language in the Natural Gas Act denying FPC jurisdiction over production and gathering operations. Little wonder then that crude-oil producers, natural-gasoline manufacturers, and even gas-well operators are reluctant to yield any more of their independence to sell their commodities on a free market.

These privileges, of course, might well be sacrificed by any supplier connected to an interstate natural gas pipe line if FPC elects to act under authority of the Canadian River decision. FPC protestations of good faith and of harboring no intent to regulate prices at the producing and gathering level are not enough. The industry needs assurances in more tangible form. Only when existing doubts are removed can the industry and the producing states proceed with the business of eliminating waste. Flaring is meager now in comparison to 5 years ago, but any is too much. Gas has become far too valuable to waste and a solution must be found.

The situation is not hopeless. Congress can remove any ambiguity from language of the Natural Gas Act. The FPC authority can be effectively stopped at the start and at the end of interstate transmission facilities. But it appears that clarification of the law is the only appropriate and conclusive way open to the industry to correct the interpretation of the existing statute. In fact, Congress is practically compelled to act if its intent is to prevail.

INTERNATIONAL

Oil Production Rises, but Exports Fall, in Mexico

Oil operations in Mexico, virtually all supervised by Petroleos Mexicanos, underwent no material change in 1944. Production rose several million barrels, but exports continued to drop, declining about 12 per cent from the 1943 figures. Although refinery and storage capacity increased slightly, movement of refined products to the interior and Pacific Coast was subnormal.

Scarcities, especially in fuel oil and gasoline, caused by shortage of tank cars, became even more serious. Many industrial firms were forced to suspend operations until stocks could be replenished. Lack of automotive fuel was particularly serious along the main highways from Mexico City to Laredo, Guadalajara, and Acapulco, causing difficulties for public as well as private transportation.

Because of the proximity of the Atzcapotzalco refinery, which is supplied with crude oil by a 10-in. pipe line from Poza Rica oil field, the Federal District fared better than many other parts of the country In September, however, the pipe line was damaged by storms, and gasoline rationing became temporarily necessary.

According to a report of Petroleos Mexicanos, 24 of the 37 wells drilled during the year were productive.

Construction continued on the high-octane plant in Mexico City, but at the year's end the foundations were only partially completed. It is thought the plant will not be ready for operation before 1946.

Efforts will be made by Petroleos Mexicanos during 1945 to step up production of refined products to 42,000,000 bbl. and increase exports to approximately 6,500,000 bbl. Paraffin production is expected to be expanded to between 10,000 and 15,000 tons. At the same time work on the Poza Rica-Irapuato pipe line will be commenced, and it is expected that 71 new wells, 36 of which will be located in productive zones, will be drilled.

Elliott Made Officer of Standard-Vacuum Oil Co.

L. W. Elliott, who is retiring to an inactive status as colonel of the United States Army after 3 years' duty in the Pacific area, has been elected vice president and a director of the Standard-Vacuum Oil Co., with headquarters in New York City. He will be in charge of the production activities of the company.

Elliott was general manager of the Standard-Vacuum operations in Java and Sumatra of the East Indies in 1942 at the time of the Japanese invasion. He assisted the Netherlands army in the destruction of the company's oil properties, including the $30,000,000 refinery at Palembang, Sumatra. With other employes of the company he was able to escape and immediately joined the U. S. Army, later becoming attached to the headquarters staff of General McArthur.

Mrs. Elliott remained at Java until the last minute before Japanese invasion forces moved in. After escaping to Australia she came to the United States and engaged in important war work for the Netherlands Government while Colonel Elliott served in the Army.

On June 6 he was given the Distinguished Service Medal, a presidential citation for services as a member of General McArthur's staff. The citation is for his work in handling all oil-supply operations in the Southwest Pacific for the Army, Navy and Air forces. He has taken part in several engagements and landed with the advance troops in the Leyte and Luzon invasions of the Philippines. In these invasions he directed the work of laying pipe lines and erecting storage supplying petroleum for the invasion forces.

Elliott became associated with the Standard of New Jersey operations in the East Indies in 1924. Previously he had been employed in the oil fields of Mexico and the United States. The Standard-Vacuum company is now jointly owned by the Standard Oil Co. of New Jersey and the Socony-Vacuum Oil Co., Inc. with extensive marketing interests throughout the Orient in addition to the production and refinery operations in the East Indies. Most of its properties are now in the hands of the Japanese.

Col. G. S. Beurket, commandant at Fort Jay, New York, congratulating Col. Lloyd W. Elliott on his service record which has won for him the distinguished service citation

Oil From Casabe Flowing To Pacific War Zone

Oil from the Casabe field in the Yondo concession of Shell Oil Co. of Colombia, Ltd., started flowing June 6 through Shell's 6.2-mile connecting line and the 317-mile common carrier of Andian National Corp., Ltd., to the Mamonal export terminal and thence to the Pacific war zone and world markets. This established the legal beginning of the 30 years granted Shell to exploit the concession, which may be renewed for an additional 10 years. Thus, in 1985 the Yondo concession will have lapsed.

The Yondo concession is the first made under the Colombian oil law of 1931 to reach the commercial exploitation stage with movement of crude from the Casabe field. The two other grants, De Mares and Barco, which operate under special contracts of 1919 and 1931, respectively, started pipe-line shipments in 1926 and 1939. Casabe oil will increase Colombia's crude output some 14.5 per cent over current production. It runs about 21.5° and has a high-octane aviation base stock, also a good lubricant cut. Motor fuel yield is low.

Kuwait Oil Shipments to Start Early Next Year

First shipments of crude oil from Kuwait, the small shiekdom on the Persian Gulf, will start during the first quarter of 1946, it was disclosed last week in Pittsburgh by J. F. Drake, president of Gulf Oil Corp. Additional drilling work is scheduled during remainder of this year to supplement the nine oil wells completed on the Gulf and Anglo-Iranian Oil Co. concession before the war interrupted development.

Gulf and Anglo-Iranian acquired the Kuwait concession 11 years ago but have made no commercial disposition of crude oil up to the present time. Contracts have been negotiated with French refining interests for Kuwait crude.

Reserves of Kuwait are currently estimated from 4,000,000,000 to 10,000,000,000 bbl. A thick and uniform reservoir sand existing under proven portions of the Kuwait pool has caused geologists to compare the pool with a huge underground storage tank.

Refiners Cannot Absorb Crude Price Rise, Committee Is Told

by Arch L. Foster

WASHINGTON.—The petroleum refiner's margin between present crude prices and the total return from finished products is far too narrow to permit him to absorb any proposed crude-price increase, the Patman small-business committee was told here last week in a comprehensive report by the National Industry Refiners Advisory Committee, a group appointed by the Office of Price Administration. That margin has reached the vanishing point in many cases, and is lower than in many years, the report indicated.

At the same time the advisory committee turned thumbs-down on the idea of a subsidy from the federal Government to cover this price increase. It is impossible to predetermine the amount of such a subsidy which is equitable, the advisers said. Renegotiation of war contracts will not occur for months after the close of a given period, and only then will the refiners know just what gross or net return they have had from operations. Refiners cannot operate on the prospect of a subsidy to come in the future, when they do not know when or how much it will be.

As result of several surveys, the advisory committee reported its belief that the margin of the refiner is smaller now than it was in 1941. Surveying the situation in terms of the calculated value of all refined products from a barrel of crude, based on quoted market prices and average yields at the refinery, and subtracting the price of crude in the field, the committee determined that the margin of costs and prices for the refiner during the years 1936, 1937, and 1939 was 65.3 cents per barrel. This differential must cover pipe-line transport and all refining costs, including amortization, fixed and overhead charges, operating costs, losses and all other charges including income and other taxes. The refiner cannot count the extra profits made from war products, in the postwar estimates since these extra returns will not be received then under peacetime conditions. Nineteen thirty-eight was a mild depression year with a lower return, making the average for four prewar years 52.5 cents per barrel. The index or margin was frozen in 1941 at about 70 cents, based on normal product flow; this product flow has not been normal during wartime, and by 1944 this index was reduced to about 58 cents. At the same time yields of main products have changed radically as shown in the table:

	Yields, %	
Product—	1941	1944
Gasoline	51.5	44.95
Distillate fuels	10.50	14.36
Residual fuels	25.66	27.43

Consequently with a smaller gross margin or index per barrel and with lower yields of most expensive products the refiner's margin for profit has been steadily diminishing, the report indicates.

Careful estimates by the best informed men of the industry show the following costs which must be paid out of the margin of gross profit in the Mid-Continent; transport of crude from field to refinery, (average) 10.89 cents; direct refining expense, 22.38 cents; general costs, depreciation, taxes, etc., 14.21 cents; profit margin (58 cents less total of above items), 10.517 cents.

Gulf Coast Margin

For the Gulf Coast, the gross margin after deducting transportation to refinery is, by years:

	Cents per barrel		Cents per barrel
1935	43.7	1940	35.7
1936	47.5	1941	38.3
1937	49.6	1942	32.4
1938	22.4	1943	39.0
1939	41.3	1944	40.5
Average		39.04 cents	

Average direct refining costs in Gulf Coast range between 30 and 35 cents per barrel.

Survey by PIWC shows that 51 refineries, processing 268,000 bbl. per day of crude, during a 9-month period in 1944 showed net income before taxes of 19.26 cents per barrel. Estimates of net return after taxes ranges from 4 to 10 cents per barrel. Returns from 14 Michigan refineries, October 1, 1944, to April 1, 1945, showed profit before income taxes of 0 to 28 cents per barrel, average 18.76 cents. After income taxes are paid the average is 7.6 cents, none more than 10 cents.

These figures show, according to the report, that no crude price increase whatever can be absorbed by the refiner under present conditions. Refining costs are up in several categories, it was shown, due to:

1. Wage rates are up 30 per cent since 1941.

2. Disruption of normally trained personnel and introduction of new, more complicated processes, has cut individual employe's efficiency.

3. Higher labor turnover has required higher training costs.

4. Costs of repairs and maintenance considerably higher.

5. More shutdown time is the case, due to inability to replace worn equipment.

6. Postwar will entail extra charges due to premature obsolescence.

7. Postwar replacement will be more costly; now about 50 per cent greater than prewar figures.

The report further sums up many other factors, especially those which militate against predetermination of an equitable subsidy rate or plan for refiners. Each refiner uses a different accounting system, it is stated, and therefore no general subsidy plan or system of calculating it can be practicable. As has been the case in past years when a "cost-plus" plan has been adopted, it has been impossible to accredit properly the value of various cost items.

The only equitable way to handle this matter, the advisory committee states, is to increase market prices for finished products in proportion to the crude-price raise, and that plan is recommended to the Patman committee.

Supreme Court Refuses to Consider Humble Case

WASHINGTON.—U. S. Supreme Court this week refused to consider the controversy between Humble Oil & Refining Co. and Oil Workers International Union (C.I.O.), which recently prompted President Truman to issue a seizure order against the company's refinery at Ingleside, Tex. Actual seizure was stayed when Humble obtained a temporary injunction from a District Court in Texas.

Humble asked the Supreme Court to rule whether lower courts have power to restrain National War Labor Board and the Eighth Regional War Labor Board on Humble's contention that the boards "are seeking by underhanded and secretive ways and means to coerce and compel" it to obey a WLB order.

The order required maintenance of union membership. U. S. District Court at Dallas found illegal sanctions were imposed against Humble. It granted a preliminary injunction against WLB. The Fifth Federal Circuit Court reversed the District Court.

While Humble's petition for a Supreme Court review of the Circuit Court action was pending, President Truman ordered seizure of the Ingleside plant.

Jersey Standard Officials Investigate War Damage

NEW YORK.—Eugene Holman, president of Standard Oil Co. (New Jersey); Orville Harden, vice president, and Bushrod B. Howard, director of the marine division, have left for Europe to study war damage to company properties in England and on the European continent and to estimate costs of rehabilitation.

Holman said the company already had filed claims with the State Department for war damage and that while abroad he would consider filing claims with the local governments in Europe.

He said surveys would be made of all company installations, including storage depots, bulk stations and refineries. He could not give an estimate of the total damage, but indicated it would run into millions of dollars. A reserve of $105,000,000, representing the book value of the European properties, has been set up, he revealed, adding, "I am sure we could not replace all our installations in Europe, if they have been destroyed, for anywhere near that figure."

Under orders from local governments, Holman said, the company destroyed some of its installations, and these losses would be included in its claims. He did not know how the claims would be handled under international law, but expressed the opinion that this would be affected by the peace treaty.

Standard is without information on the state of its interests in the Dutch West Indies, which it owns jointly with Socony-Vacuum Oil Co. through Standard Vacuum Co. These properties include oil fields and refineries on Borneo and Sumatra. At Palembang, Sumatra, the Standard-Vacuum refinery was destroyed by company personnel before Japanese occupation. Unofficial estimates of the cost of rebuilding run from $40,000,000 to $50,000,000.

Socony-Vacuum Oil Co., Inc., also has sent representatives to Europe to survey war damage and to appraise near-term and long-term demand and operating conditions.

Indiana Standard Soldiers To Get Jobs and Benefits

CHICAGO.—The 3,500 employes of Standard Oil Co. (Indiana) still in the armed services and merchant marine will find jobs waiting for them when they return, along with benefits beyond those fixed by veterans' legislation. This is assured by a letter soon to be mailed to them by Robert E. Wilson, chairman of the board, and A. W. Peake, president. Among features of the reemployment plan approved by the board of directors are the following:

1. All who were regular employes will, as a minimum, be restored to the positions in which they last worked on a regular basis or to positions of the same relative standing. Under certain conditions, they will get better jobs and pay.

2. Those who may be unable to resume their previous work because of war disability will be offered other positions which they can be trained to fill. No veteran will be refused employment because of disability if a job can be found which he can perform without creating a safety hazard.

3. While legislation makes no provision for employes leaving temporary positions every effort will be made to place former temporary employes also.

4. Time spent in war service is to be counted as time worked for the company in computing company service.

5. Pay will start the day the veteran reports, if he goes to work the following day.

6. Regardless of when the veteran returns, he will become eligible for vacation on the same basis as if he had not been away.

7. Full resumption of eligibility to benefits of company welfare plans is assured.

8. Special consideration will be given in individual cases wherever and whenever necessary.

9. The majority will receive not only one month's pay granted on entry into service, but also a second month's pay on returning.

10. While the welcome home will be hearty and sincere, veterans will not be embarrassed by elaborate receptions or "re-orientation" programs. Quiet restoration to employment and training on the job will be the plan for making them feel at home.

11. Special leaves, without pay, will be granted to veterans who wish to avail themselves of opportunities offered by the Government for rehabilitation, training, or education.

PAW Wants Higher Output Of West Texas Crude

AUSTIN.—Indication of the heightened value of sour crude in the war effort is seen in the action of Petroleum Administration for War, which has certified an increase of 10,000 bbl. daily in production from the West Texas field in July. The crude, which yields a heavy cut of fuel oil, can be moved to Pacific Coast refineries by tank car. The additional output from West Texas is to be gained by a reduction of 10,000 bbl. daily in Southwest Texas. The total certification for July in Texas is unchanged at 2,333,000 bbl. daily of all petroleum liquids. Of this volume 2,170,000 bbl. is to be crude oil and the rest natural gasoline and condensates.

Penalties Relaxed on Tank-Car Demurrage

WASHINGTON.—Because a few additional tankers have been placed in the coastwise petroleum service, thus relieving somewhat the critical shortage of tank cars, the Interstate Commerce Commission last week suspended temporarily existing heavy penalties on holding loaded tank cars at destination points.

Supreme Court to Review Champlin Pipe-Line Case

WASHINGTON.—U. S. Supreme Court this week agreed to review a Federal District Court decision that a pipe line constructed by Champlin Refining Co. is a common carrier, under jurisdiction of Interstate Commerce Commission. The line extending from the Champlin refinery at Enid, Okla., to terminals at Hutchinson, Kans.; Superior, Neb., and Rock Rapids, Iowa, is used for transportation of petroleum products.

A special three-judge federal court in the western Oklahoma district decided the line was a common carrier within meaning of the Interstate Commerce Act.

DEATHS

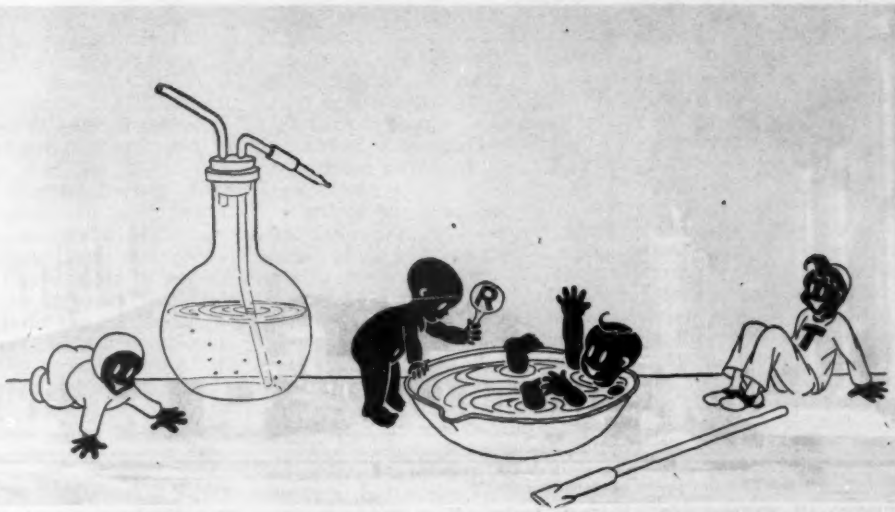
Phil T. Williams, 50, chairman of the national council of Independent Petroleum Association, member of Petroleum Industry War Council, and president of Indiana Independent Petroleum Association, died June 13 in Indianapolis.

R. E. Allison, 65, oil operator and contractor, died June 13 in Shreveport. He was credited with having drilled the first gas well in the Monroe field.

W. S. Randall, 62, independent oil operator, died June 11 in San Antonio. His interests were in West Texas and New Mexico at the time of his death. He was a graduate of University of Iowa.

John L. Lamkin, 62, oil operator of Fort Worth, died June 9 at Big Spring, Tex., where he had gone on a business trip.

Lee R. Sterling, 40, production superintendent for Phillips Petroleum Co. in the West Texas-New Mexico district, died June 13, of a heart attack, in Odessa, Tex.



Test Tube Baby #4
Dehydrogenation

Dehydrogenation is the removal of hydro gen from hydrocarbons. Butanes form butylenes; butylenes form butadiene; isopentane forms isoprene; and ethyl benzene forms styrene. UOP chemists recognized the value of this reaction long before the need for synthetic rubber developed.

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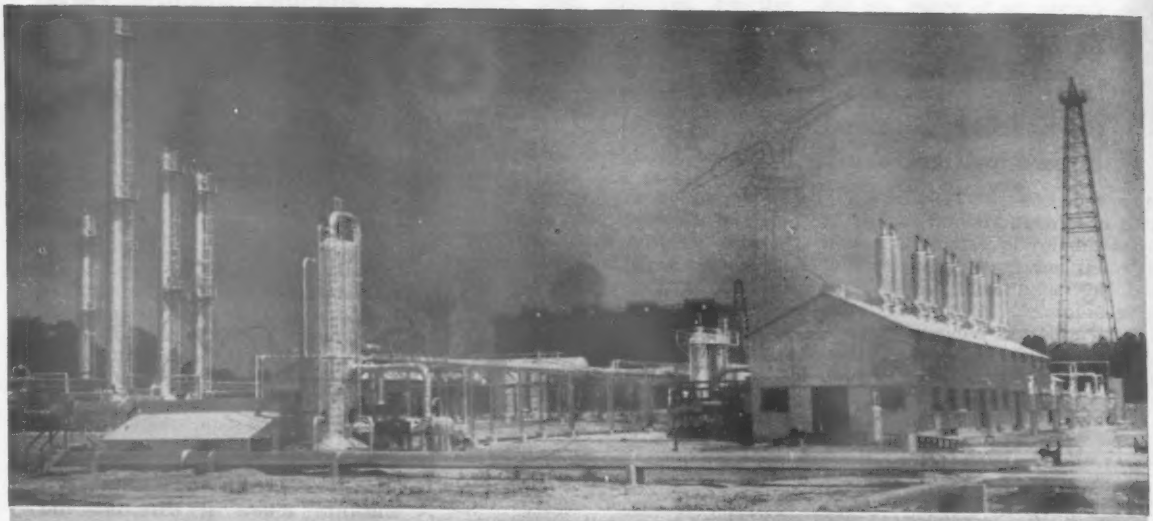


Haynesville natural-gasoline plant with main separator in left foreground

Haynesville Plant Recovers Production From Entire Field

by Arch L. Foster

Collecting all crude oil and gas produced in the Haynesville field of northern Louisiana into one depot and processing the gas to recover light products, finally recompressing the stripped gas for maintenance of pressure in the same field, are the main accomplishments presented in this article. The plant utilizes a reabsorber and fat-oil stabilizer step to take part of the load off the main fractionator, also vents the fat oil for the same reason. It makes isobutane or isopentane of high purity in addition to conventional grades of natural gasoline.

Battery of fractionators at natural-gasoline plant

GATHERING and separating crude and gas from an entire producing field, processing the gas and returning it to maintain formation pressure in the same field, and segregating the crude for distribution is the manifold job of the Haynesville Operators Committee, headed by J. R. Butler, general manager of both Cotton Valley and Haynesville Operators Committees, in northern Louisiana. The three-way job is one of the outstanding accomplishments in this entire region and in fact, in the entire industry. This article deals only with the design and operation of the gasoline-recovery plant built by Jones & Laughlin Supply Co. and operated as a part of the complete pressure-maintenance system.

Briefly the part of the system in direct connection with the gasoline plant includes the main gathering lines from field to plant; a separator which divides crude from gases; absorber, stabilizer and still towers; depropanizer, debutanizer and deisobutanizer towers; water-cooling tower; boiler unit and generator unit; crude tanks, compressor units and auxiliary installations. The separator is a vertical column, 8 by 35 ft., equipped with exchangers in which the crude-gas mixture may be either heated or cooled as desired. The main suction scrubber is 8 by 14 ft., equipped with a Magnetrol high-level alarm and shutdown and with pumps which transfer condensate to mingle with that from other scrubbers. The five four-stage compressors, 800-hp. Clark gas-engine driven, are the heart of both the gasoline plant and the pressure-maintenance system.

Each stage has a discharge scrubber and a cooler ranging in size

from a 3-ft. 6-in. by 12-ft. scrubber for the third-stage discharge to 6 by 12 ft. for the first-stage scrubber; coolers are made up of two 6 by 24-ft. sections in parallel, typical exchangers in general construction. Two dehydrators are used in parallel, 3-ft. 6-in. by 20-ft. size, loaded with Florite. To dry these units after saturation with water from the gas, a portion of dry gas is heated with steam and passed through the dehydrators in reverse direction which picks up the water and carries it to the cooler in the cooling tower and to a scrubber where it drops out, leaving this portion of gas relatively dry again. An after scrubber is placed in the gas line immediately following the dehydrators, through which dehydrated gas passes.

The absorber column is a 3-ft. 6-in. by 60-ft. tower containing 20 bubble trays and provided with a gas heater exchanger. The reabsorber and fat-oil stabilizer is 3 ft. 6 in. by 64 ft., equipped with 22 bubble trays and connected to a rich-oil vent tank as an integral part of the plant's design. Three oil-to-oil heat exchangers in series, with 27-in. shells and 16-ft. tubes and having 3,360 sq. ft. of exchange surface are placed ahead of the still. A steam preheater, 20-in. shell, 16-ft. tubes having 840 sq. ft. of surface, is placed immediately ahead of the still. One auxiliary item is that 100-lb. steam to be admitted to the base of the still as stripping steam is dried in exchange with 250-lb. steam in a dryer unit with (Griscom-Russell) 51 sq. ft. of twin G-fin tube surface), alongside the still column.

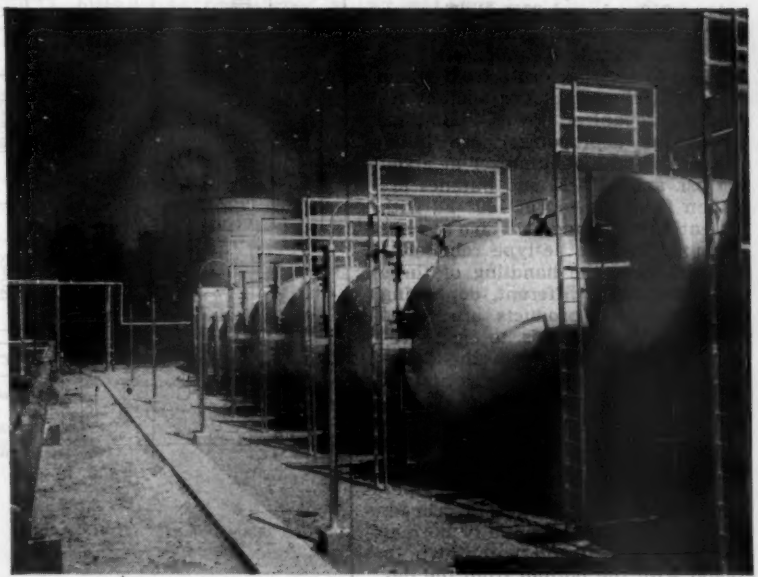
The depropanizer tower is 3 by 65 ft., provided with 36 bubble trays and a kettle-type reboiler, steam heated. The debutanizer is 4 ft. 6 in. by 78 ft., equipped with 45 bubble trays, and with a kettle-type reboiler, steam heated and with 12-ft. tubes. The deisobutanizer (deisopentanizer) column is 4 ft. 6 in. by 116 ft., fitted with 70 bubble trays and a steam-heated, thermosiphon-type reboiler with 20-in. shell and 16-ft. tubes having 370 sq. ft. of surface for this very important step. The cooling tower is a Hudson induced draft, louvered tower, with all condenser coils set in it just above ground level, with downflowing water dripping over the coils. The crude storage includes three 15,000-bbl. floating-roof tanks of C. B. & I. manufacture. The three boilers are Vogt water tube of 250 b.hp. each, set in air-cooled walls, and using Fan-mix burners. At least 11 centrifugal pumps of Ingersoll-Rand and Byron Jackson makes are employed in the plant with others used for various purposes. Some 19 Union steam reciprocating pumps are also used. The plant water is supplied from a 625-ft. water well with a B-J electric-motor-driven pump set 300 ft. down in the well. Elliott steam turbines are used to drive many of the pumps, as are the four cooling-tower induced-draft fans. Even the boiler feed pumps are centrifugal. Plant electric current is supplied by two steam-turbine-driven 75 kva. generators.

Comprehensive automatic recording, indicating, and control provisions enable operation of the plant with a minimum staff, a great advantage in this period of labor scarcity. On the main control board are provided six Brown temperature recorder controllers, governing the towers, kettles, preheaters, etc. Twelve Foxboro pressure and flow controllers are also provided to control the fractionation and absorption batteries. A number of other recorders, controllers, and regulators are provided in the plant, located at or near the point where control is exercised or a condition is recorded. Three men per shift are able to run the plant conveniently.

The plant is designed for handling 15,000,000 cu. ft. of raw gas per day. Gas and crude are produced in the field, separated at each well for metering, then recombined and brought to the plant in five main gathering lines, combining into one 24-in. header 600 ft. long at the plant. The oil-gas mixture is flashed in the plant separator at such temperature as may prevail and at 28-30 psi. pressure. From the separator crude goes to the three 15,000-bbl. floating-roof tanks and has no further part in the plant process.

From the separator overhead the raw gas goes to the first three stages of the compressor battery, is raised to 775 psi. with cooling between stages and is delivered at about 90° F. to the absorber bottom inlet. The stripped gas is dehydrated and returns to the fourth stage of the compressors, its pressure is boosted to 2,100-2,700 psi., cooled and delivered to the extra-heavy lines and is returned to the gas-injection wells, of which five are now used

Compressor house at natural-gasoline plant



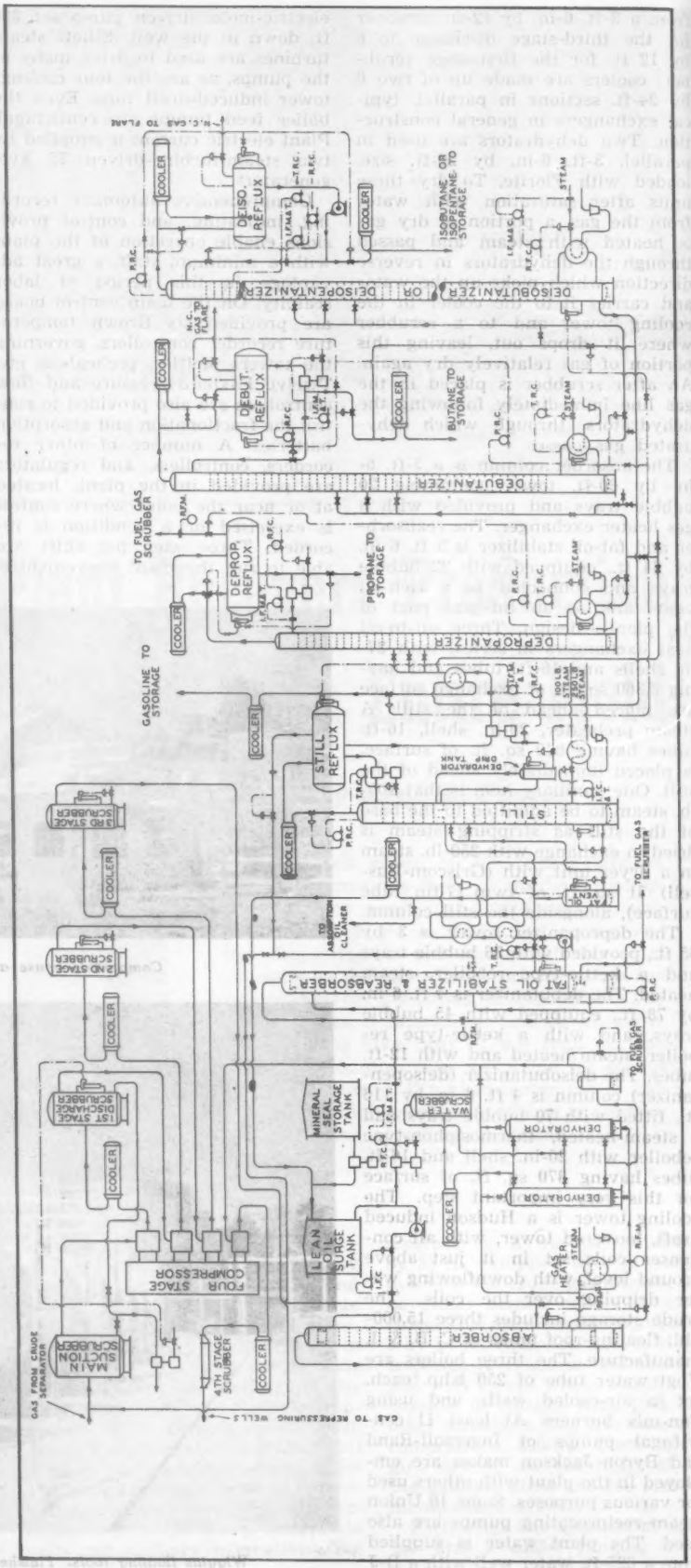
Wiggins floating roofs. Finished-products storage in foreground

to maintain pressure on the field.

The fat oil from the bottom of the absorber is passed to the stabilizer, its temperature raised to 150° F., a rise obtained by inletting hot gases from the fat-oil vent tank. The stabilizer is operated at about 80 psi. The stabilized fat oil is passed to the three oil-to-oil exchangers, to the steam preheater and then enters the fat-oil vent tank at about 375° F. from the top of which light absorbed gases are vented to the reabsorber stabilizer at a point near the bottom, there heating the incoming fat oil to effect stabilization of the fat oil. This is one of the features of the operation of the plant. This venting takes a considerable amount of material load off the still and the condenser later, heats the fat oil to stabilize it and permits sharper fraction and stripping of the fat oil. Any recoverable hydrocarbons which escape from the fat oil in this vent tank are reabsorbed in the reabsorber stabilizer thus saved for inclusion in the product. The reabsorber stabilizer thus serves as a stripper for the light product from the fat-oil vent tank and recovering "trap" to prevent loss of desirable hydrocarbons while reducing the load on the still proper.

Hot fat oil from the vent tank bottom passes directly to the still at approximately 375° F. and 75 psi. Stripped of its light product the lean oil gives up heat to the incoming fat oil, is cooled further in two parallel water coolers and is stored in the 10 by 15-ft. lean oil surge tank for reuse in the cycle. Overhead vapors from the still are condensed in three parallel condensers, preheated by exchange with bottoms from the deisobutanizer and enter the depropanizer column at about 250 psi. and 235° F. The propane vapors overhead are condensed in two parallel condensers and passed to a reflux drum from which the reflux pump takes suction for the depropanizer tower. Bottoms from the depropanizer are introduced into the debutanizer at about 85 psi. and 227° F. and butanes are taken from the top at 140° F., with essentially butane-free bottoms stripped in a kettle-type reboiler.

From here the handling of these two streams is different, depending on just which products are to be made. If isobutane is to be segregated, the bottoms from the debutanizer are run to storage as natural gasoline. The mixed butanes overhead pass to the deisobutanizer tower with a bottom temperature of 205° F. and 50 psi.; with a 155° F. top temperature isobutane of 95 per cent or higher purity goes overhead, and the bottoms, essentially normal butane, stripped and withdrawn to blend with the bottom from the debutanizer as the natural-gasoline



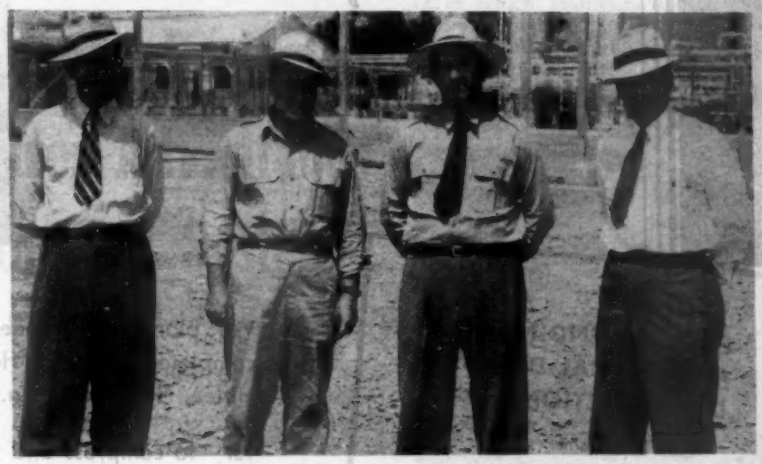
Flow chart of Haynesville natural-gasoline plant and pressure-maintenance project

Left: Induced-draft water-cooling tower with all condensers on ground level, at Haynesville natural-gasoline plant. Right: Outdoor-type boilers

product of the plant, which is the whole stabilized product less the isobutane.

If isopentane is the special product desired from the system, plus the natural gasoline, the semistabilized product from the still is run to the debutanizer in the manner already described. Butanes are taken overhead, condensed and held in storage for blending. The butane-free bottoms product passes to the last tower which becomes the deisopentanizer, at about 180° F. and 35 psi. Practically pure isopentane—98 per cent or higher—is taken overhead at about 165° F. top temperature and the resulting debutanized, deisopentanized bottoms — hexanes and heavier—are blended with the mixed butanes from the butanizer overhead to form the natural gasoline product of the plant.

In the accompanying Table 1 is



The Haynesville Operators Committee technical staff consists of C. B. McEachern, engineer; Charlie Sweeney, plant superintendent; H. B. Johnson, general superintendent, and J. R. Butler, general manager

TABLE 1—HAYNESVILLE OPERATORS COMMITTEE PLANT BALANCE

Losses—	Methane, M.c.f.	Ethane, M.c.f.	Propane M.c.f.	Propane Gal.	Isobutane M.c.f.	Isobutane Gal.	n-Butane M.c.f.	n-Butane Gal.	Isopentane M.c.f.	Isopentane Gal.	n-Pentane M.c.f.	n-Pentane Gal.	Hexanes+ M.c.f.	Hexanes+ Gal.	Total M.c.f.	Total Gal.
Absorber residue gas	14,494.5	385.5	100.5	2,757	12.0	392	7.5	236	....	....	....	....	....	....	15,000.0	628
Reabsorber residue gas	648.9	46.7	13.1	359	.8	20	.9	28	....	....	....	....	....	....	710.2	48
Depropanizer residue gas	15.0	31.6	82.7	2,268	.1	3	.8	25	....	....	....	....	....	....	130.2	29
Total residue gas	15,158.4	463.8	196.3	5,384	12.7	415	9.2	289	....	....	....	....	....	....	15,840.4	704
Products:																
Butane			....	....	73.3	2,392	223.3	7,025	....	....	....	....	....	....	296.6	9,417
Isopentane					.1	4			105.3	3,843	3.9	140	....	....	109.3	3,987
Gasoline			....	....	....	....	....	....	....	....	130.8	4,726	225.5	10,769	356.3	15,495
Total products					73.3	2,392	223.4	7,029	105.3	3,843	134.7	4,866	225.5	10,769	762.2	28,899
Plant intake: Total products and losses	15,158.4	463.8	196.3	5,384	86.0	2,807	232.6	7,318	105.3	3,843	134.7	4,866	225.5	10,769	16,602.6	29,603

Inlet Gas Analysis From Products and Losses

	Mol %	G.p.m.
Methane	91.30	....
Ethane	2.79	....
Propane	1.19	....
Isobutane	.52	.170
n-Butane	1.40	.440
Isopentane	.63	.230
n-Pentane	.81	.293
Hexanes+	1.36	.849
Total	100.00	1.782

$$\text{Total butane recovery} = \frac{9,421}{10,125} \times 100 = 93.05 \text{ per cent}$$

$$\text{Total pentanes recovery} = \frac{8,709}{8,709} \times 100 = 100.00 \text{ per cent}$$

(No residue gas loss)

Pressure Maintenance

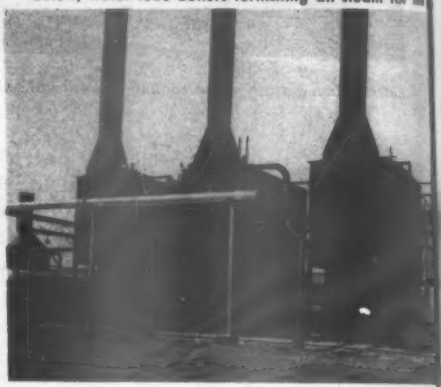
- **SOUND ENGINEERING Combines**
- **OPERATING ECONOMY with**
- **FIELD CONSERVATION**

for

Haynesville Oil Producers

Above, interior view of the 4,000 h. p. compressor

Below, water tube boilers furnishing all steam for the



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Sulphur Removal,
Treating, Utilities
and Auxiliaries

Crude Stabilization,
Crude Desalting,
Gas Compression
and Absorption,
Gasoline Stabilization,
Recycling and
Gas Lift

We planned, engineered and built this newly completed plant for Haynesville Operators Committee, Haynesville, La., to meet two objectives:

1st—to compress and return to the oil producing formation essentially all of the gas produced with the oil.

2nd—to recover casinghead gasoline and lighter hydrocarbons from the gas leaving the crude oil separator.

The plant consists of a 4,000 h. p. compressor station, an oil absorption plant, fractionating equipment for producing mixed butanes, iso-pentane and casinghead gasoline, and a solid absorbent gas dehydration plant.

A unique feature of the plant, made possible by unitized operation of the field, is the central crude separation system. All crude oil and gas are handled through one large separator.

See our Refinery Catalog section—pages 441-452

given a typical plant balance for this operation.

Outstanding in the design and operation of this plant are the provisions for conservation of energy, of raw products made, and for isolation of the special products most desired at any given time. Isobutane is an indispensable intermediate for the production of alkylate for aviation superfuels. Isopentane is a blending material par excellence for the purpose in aviation superfuels, "as is." Symmetry of design and layout is achieved by installing all the condensers and coolers in the base of the water-cooling tower, at the same time obtaining very efficient condensing operations. Flashing or venting the preheated fat oil to take some of the vapor load off the still is not common practice, it is believed. Lastly, an advantage is found in bringing all the crude-gas mixture into the common separator, making for the production of a more uniform crude and uniform raw gas to plant operations. By splitting the compression cycle and reserving the highest stage, up to 2,100 psi. or higher, to handle only the stripped dry gas, a more efficient compression system is attained.

Acknowledgment is made of the kind cooperation of J. H. Butler, general manager of the Cotton Valley and Haynesville Operators Committees; H. B. Johnson, general manager at Haynesville; Charles Sweeney, superintendent of the natural gasoline plant, and C. B. McEachern, plant and field engineer of this project.

Pressure-Maintenance Project at Haynesville Utilizes Advantages Of Central Gathering System

by E. H. Short, Jr.

THE recently completed Haynesville pressure-maintenance project involves 13,940 acres centering near 15-23n-8w, Claiborne Parish, Louisiana. The program is typical in many ways of a constantly expanding production technique designed for maximum recovery of liquid products.

This program embraces 185 wells producing in the Pettit lime reservoir. By the end of 1942, 130 Pettit-lime producing wells had been completed. In 1943, 29 producing wells were completed, and in 1944, 21 wells were completed as producers. Up to the present time, five have been completed during 1945.

Completion practices in the Haynesville pool were described in the May 19 Journal, starting on page 135. The earlier discussion covered many of the reservoir characteristics and presented data on production, pressure, permeability, pay thickness, gas-oil ratio, and cumulative recovery. The present article describes the field gathering system, factors in unit-operating agreement and completes presentation of one of the most modern producing programs in the Southwest.

Gathering System

Oil and gas produced from all wells enter a central separator and tank system located at the plant. Fig. 1 shows a typical producing-well hookup and Fig. 2 is a closeup of an oil meter which is installed at each well. The wells in the field are tubed with 2 or 2½-in. tubing.

The field gathering system consists of approximately 67 miles of pipe varying in size from 3 to 20 in. Branch lines from the wells are 3 and 4 in., and the five main lines gradually increase in diameter from 3 and 4 in. in the outermost portions of the field in increments of approximately 2 in. to a maximum of 20 in. One line is 20 in. in diameter for more than 1 mile before it connects with the plant header. Another line has also been increased to 20 in. for a distance of ½ mile before it reaches the plant. The other three gathering lines entering the plant header system are 12, 14, and 16 in. The maximum well separator pressure ranges from 54 to 60 psi. Fig. 3 shows a portion of the plant header system and Fig. 4 is a close up of the 14-in. Nordstrom valve controls on the plant header.

Incoming gas and oil from the field gathering system enters an 8 by 33-ft. separator at the plant. Pressure carried on the bottom part of the separator, which is divided into two parts, is approximately 29 psi. Pressure on the top portion runs about 20 psi. The separator is equipped with a motor controlled valve which maintains the desired pressure on the top portion. With a constant intake pressure the storage capacity of the lines is utilized in taking care of surging and heading of wells.

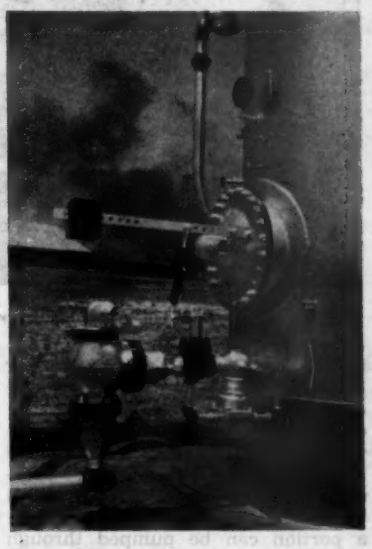

Fig. 2—Niagara oil meter installation. A setting of this type is located at each well

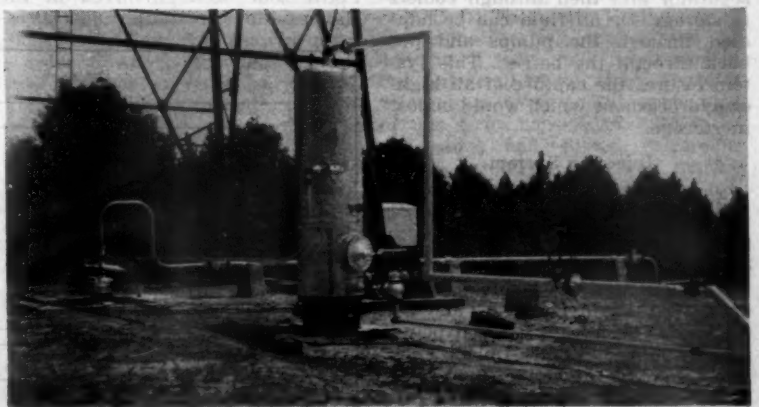

Fig. 1—Typical Pettit producing well at Haynesville

Fig. 3—Portion of plant gas-oil header system

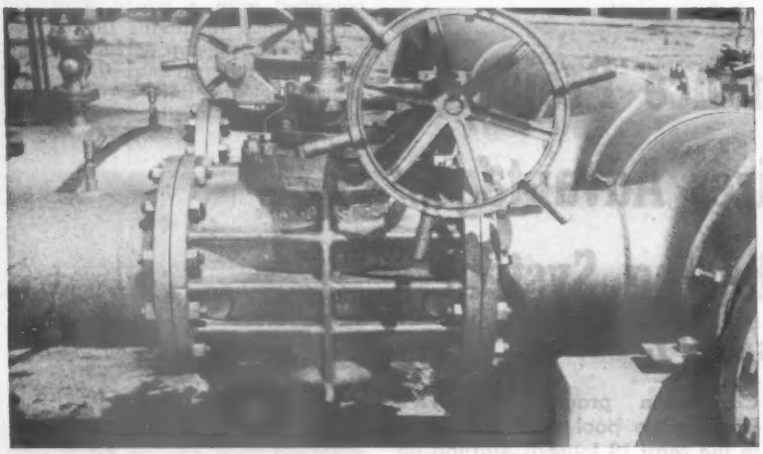

Fig. 4—A 14-in. Nordstrom valve control on plant header system

Fig. 5 is the crude-oil-separator flow diagram. It will be noted that considerable flexibility has been incorporated into this design. A portion of the crude oil is pumped through the heat exchangers; however, the hookup will permit all oil to be flowed to the storage tanks or a portion can be pumped through the heat exchangers and then over the baffles in the top part of the separator and then through coolers to storage. Or all fluid can be handled through the pumps and put back through the baffles. This system insures the capture of all higher hydrocarbons which would be lost in storage.

Injection System

A typical Haynesville injection well is shown in Fig. 6 and Fig. 7 shows the injection pipe-line system and location of the input wells.

Gas injection was begun on January 24, 1945, in one well, and by the end of the month gas was being injected into four wells. During February another injection well was tied into the injection system. The well-head injection pressures vary between 1,800 and 2,100 psi. The cumulative gas injection through April in all wells amounted to 979,912,000 cu. ft. At the present time the total daily average volume of gas being injected into all wells is approximately 13,300,000 cu. ft., with approximately 1,940,000 cu. ft. being used for boiler and compressor fuel.

Operating Agreement

The operators of one or more Pettit zone wells involved in the Haynesville Unitization and Pressure Maintenance Agreement are as follows:

Arkansas Fuel Oil Co., Blackwell Oil & Gas Co., Cook Drilling Co., Gulf Refining Co., W. B. Hinton, T. L. James & Co., Inc., E. C. Johnston, Magnolia Petroleum Co., Midstates Oil Corp., Skelly Oil Co., The Ohio Oil Co., Phillips Petroleum Co., Robert A. Stacy, M. Ascher, Kingwood Oil Co., White & Hinton, Sohio Petroleum Co.

• The Operators Committee is composed of one representative of each of the 17 participating companies, and this group has the responsibility of planning and supervising the development of the unit area.

Briefly considering the salient features of the agreement governing the unitization, it is found all oil, distillate or condensate, gas, natural gasoline, and associated hydrocarbons within the unit area are included in the contract between operating interests and royalty holders. The participation factor for a production unit (80 acres or excess) is the sum of 50 per cent of a production factor, and 50 per cent of an engineering factor. The production factor is based upon ability of wells to produce the state allowable. The engineering factor is based primarily upon acreage, thickness of the productive zone, and reservoir pressure of the production unit.

The thickness of the productive zone or zones of a production unit is determined by the geological committee from Schlumberger electrical logs if available, otherwise from the best available data. In computing the thickness of the productive zone, the weighted average thickness is obtained from isopach maps of the productive zones. These maps have been constructed from thicknesses measured on the Schlumberger electrical logs of the wells in the unit area. In measuring the thickness of the productive zones by means of Schlumberger electrical logs, only that portion of the zone is considered productive in which both the self-potential curve is in excess of 20 mv. above the average shale line

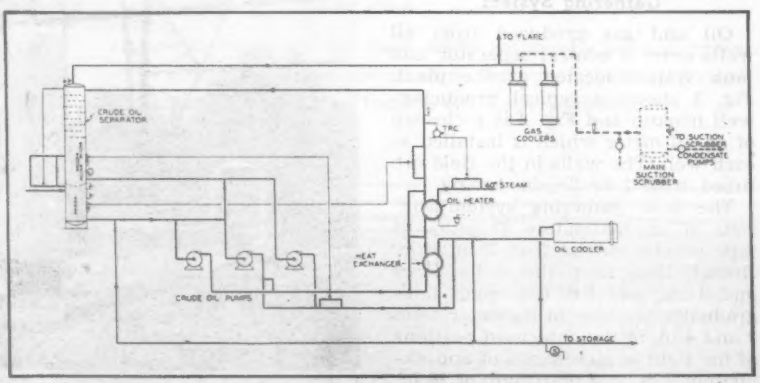

Fig. 5—Crude-oil-separator flow diagram

and the normal resistivity curve is in excess of 14 ohms. The average shale line is considered midway between a vertical line through the shale portion of the log immediately above the porosity and a vertical line through the shale portion of the log immediately below the porosity.

New wells are allowed a 90-day period, following the completion date, during which time tests are made to obtain data for determining the participation factor for the production unit.

Engineering Factor

The engineering factor for the production unit is the sum of 70 per cent of the percentage of the acre-foot pounds and 30 per cent of the adjusted acreage of the production unit. The acre-foot pounds of the production unit is the product of the adjusted acreage, thickness in feet, and adjusted official bottom-hole pressure in pounds per square inch. Percentage acre-foot pounds for the production unit is the acre-foot pounds product multiplied by 100 and divided by the summation of acre-foot pounds for all production units, including acre-foot pounds for the unit under consideration, all at the time of the official measurement of bottom-hole pressure. The summation is the total obtained by adding the products of adjusted bottom-hole pressure, thickness, and adjusted acreage for each well in the field.

As to gas-injection wells, estimates of bottom-hole pressures, in wells which have not been measured, are based on isobaric maps.

The summation of total acre-foot pounds for all wells in the field is determined by extrapolation, when necessary, from summations previously determined at the time of reservoir pressure surveys plus acre-foot-pounds for the new well or wells. The value of adjusted acreage to be used is actual acreage, not to exceed 80 acres, increased by 1 per cent for all units containing not in excess of 60 acres. Adjusted bottom-hole pressure is the pressure measured in the well at, or corrected to, a subsea depth of 5,000 ft., less 300 psi.

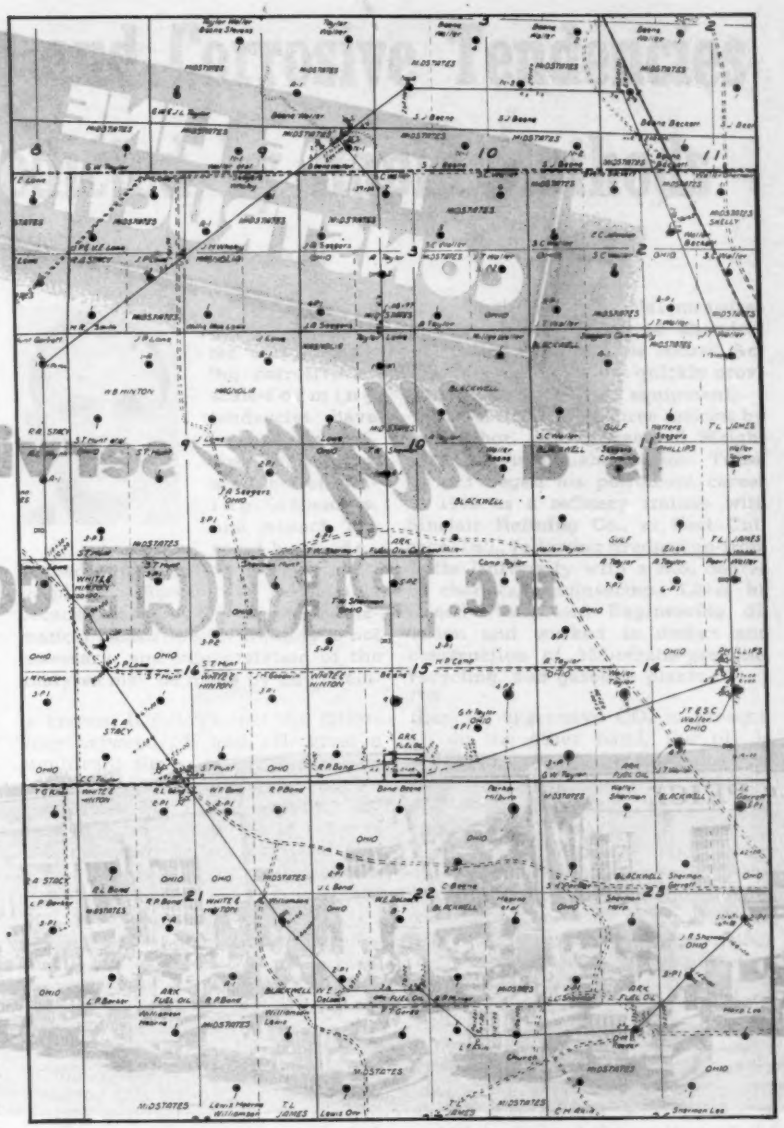

Fig. 7—Injection pipe-line system and location of input wells

Stratigraphy of the Haynesville pool, based upon the drilling record of a typical well located near the center of the field, shows that the Cook Mountain formation occurs at the surface, with lower Claiborne, Wilcox, and Midway formation next in order down to the top of the Upper Cretaceous (Gulf series) at 1,870 ft. Cretaceous formations with an aggregate thickness of 1,570 ft. are then drilled. The shallow oil sand, now largely depleted, is found at 2,772 ft. The Lower Cretaceous or Comanche series, encountered at 3,440 ft., is completely penetrated in only one well in the field. Its total thickness is 3,788 ft. The upper part of this series consists of 1,955 ft. of red sands and shales, calcareous shales, anhydrite beds and marine limestones containing the guide fossils of the Glen Rose and Travis Peak formations of Texas. The lower 1,833 ft. consists of red shales and sands locally termed the Hosston formation. The calcareous shale and limestone section which immediately overlies the Hosston red beds is called the Sligo formation. Within the Sligo occur one or more porous limestones which are collectively called the Pettit zone.

Fig. 6—Typical injection well. Tank battery in background as well as all other field batteries will be salvaged for use elsewhere. Three 1,500-bbl. Chicago Bridge & Iron Works tanks with Higgins floating roofs at plant handle all production

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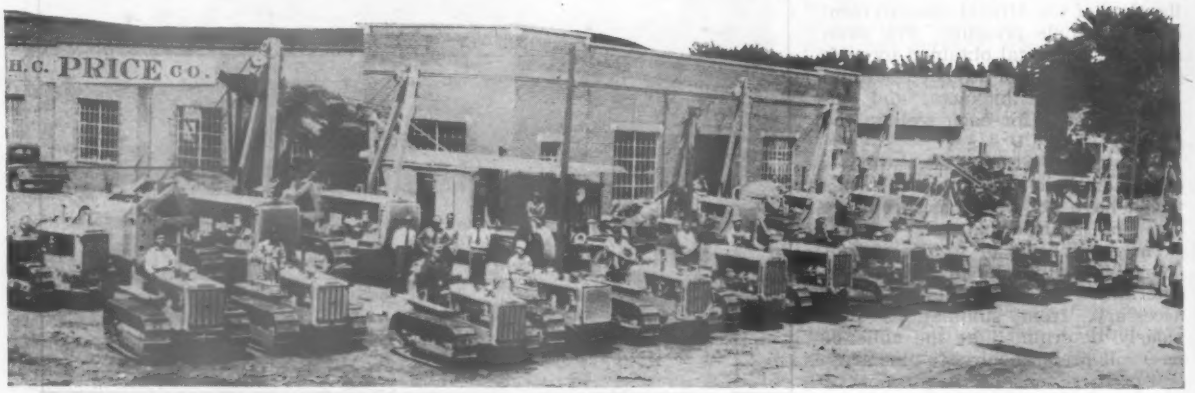

The above photograph illustrates only a portion of H. C. Price Co.'s extensive equipment. Backed with an organization having 23 years experience in the field of pipe line construction, H. C. Price Co. is a fully integrated organization equipped to handle the complete construction of any pipe line job.

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Scale-Forming and Corrosive Tendencies Of Water Predicted by Rapid Methods

by Joe R. Wright

Previous methods of testing water and predicting corrosive or scale-forming tendencies have been justly criticized in that they are time consuming, expensive, and inexact. The method described here has been shortened and simplified. Results are dependable because they have an exact mathematical basis. Special training is not necessary, and interpretation of the analyses may be made by any chemist or engineer. Remedial measures may be based on sound chemical principles before trouble occurs. Accuracy of predictions is quickly proven by observations on equipment.

This is the first of three articles by the author, who is head of Wright Petroleum Laboratories, Tulsa. Wright began his petroleum career in 1930 as a refinery trainee with Sinclair Refining Co., at East Chicago, Ind., following graduation from Tulsa University with a B.S. degree in chemical engineering. Later he joined Frick-Reid Engineering division and worked in design and construction of 100-octane-gasoline, recycling, and gasoline plants.

A GREAT deal has been published concerning scale and corrosion control in aqueous systems. Many of the earlier articles have dealt with more or less inexact methods of testing waters and controversial methods of application of data. It has long been recognized that an ordinary water analysis does not afford a basis for predicting whether a given water will be corrosive or scale forming under known conditions. General lack of understanding has led to the use of various specific tests and remedial compounds which may happen to work in some cases. Some control is not based on sound chemical principles and does not permit intelligent development and application to water-control problems in general.

Within the last few years, in water problems, recognition has been made of the basic importance of water stability as judged by "saturation index" calculations. Earliest calculations of this nature were understandable only to physical chemists and the results often were not fully accepted or understood by those directly involved in the actual water-treating work. The method of calculating water stability has now been modified, corrected, and fully proved so that the results of a water analysis may be interpreted with certainty as regards scale formation or corrosion.

Meaning of Saturation and Stability Index

It should be fully understood that water stability, as judged by saturation index calculations, depends on the CO_2 — HCO_3 equilibrium. In other words, a state of much free CO_2 will tend to cause corrosion; relatively little free CO_2 will cause $CaCO_3$ scale deposition. Saturation index originally referred to the calculated pH value at $CaCO_3$ saturation. Calculated pH value at $CaCO_3$ saturation has been designated in the literature as "pH_s" and this symbol will be used throughout this and succeeding articles.

It will be seen that there is a definite relationship between pH_s and actual pH. If pH is less than pH_s a water is "undersaturated" and a corrosive tendency shown. Reverse conditions will show a scale-forming tendency. Thus, pH_s in itself is not significant unless the actual pH is known. It follows that the difference between pH and pH_s gives a significant figure to judge the performance of a water under known conditions. The term "stability index" has been proposed to refer to the difference between pH and pH_s. It is preferred to use this term, in this discussion because of its clarity and particular significance.

A number of men have contributed worth-while efforts to the development of the stability index in its present form. Evolution of the calculation is indeed interesting and full appreciation of present methods is not obtained without briefly considering this history of development. Origin and refinement of the calculation are marked by notable achievements which constitute definite steps toward the final answer in water-analysis interpretation.

Tillmans[1] in 1915 carried out a series of experiments to determine the amounts of carbon dioxide and bicarbonate in solution under equilibrium conditions in distilled water. His tabulation of the results showed definite relationship between CO_2, HCO_3 and pH values so that any value could be estimated if the other two were known. More important, the comparison of values indicated either a scale-forming tendency or the presence of "aggressive carbon dioxide." Aggressive CO_2 was defined as the free CO_2 in excess of the amount necessary to keep the calcium present from separating out as calcium carbonate. In other words, if the determined pH value is higher than that corresponding to the bicarbonate found, according to Tillmans' table, then no aggressive CO_2 is present. If, on the other hand, the pH is lower than the corresponding bicarbonate, then the water is acid and more carbonate may be dissolved.

Baylis[2] applied the equilibrium values for alkalinity and pH to the formation and solution of calcium carbonate pipe scale in the city water of Baltimore. It was shown that if the determined pH value was above the equilibrium curve, a coating of calcium carbonate would be formed. Furthermore, if the determined pH value was below the curve the coating would be dissolved away by the water. Baylis also found that certain neutral salts in solution changed the position of the equilibrium curve. Thus it was illustrated that a new curve must be made for each kind of water.

It was probably because of the shortcomings of the Tillmans data that the von Heyer[3] "marble test" was proposed. Briefly, this test made use of a comparison of bicarbonate alkalinity before and after shaking a water sample with pulverized marble, or calcium carbonate. Hoover[4] modified the test and applied it to the problems of corrosion control in water lines. This work by Hoover showed considerable correlation of aggressive CO_2 with corrosion and "supersaturation" with scale formation.

Since 1930 there has been a great deal of discussion, and disagreement, concerning details in the technique of making the marble test and interpreting the results. In general, it came to be recognized that the test was inexact, the de-

gree of error depending largely on the duration of shaking a sample with calcium carbonate, and erroneous results might be predicted. For example, many operators in western Kansas formerly felt obliged to make the carbonate stability test on waste brines which were being injected into disposal wells. Frequently the tests indicated "undersaturation" in the waste brine when inspection showed simultaneous scale formation taking place in the injection tubing. It should be noted that this test is still recommended, in "Standard Methods for the Examination of Water and Sewage,"[5] with the statement that "the tendency of water to corrode metals or to form scale may be approximated."

Moberg[6] and others suggested in 1934 that equilibrium data for sea water could be calculated. Langelier[7] went somewhat further with the calculations in regard to dilute or fresh waters used in industry. In fact, the equations set forth by Langelier were so basically sound that they have not been changed except for residue-temperature adjustments. Langelier's original equations provided means for calculating the saturation index, commonly called the Langelier index, over a wide range of temperatures and for total solids up to about 800 p.p.m. Larson and Buswell[8] altered the formula slightly to calculate somewhat more precisely the effect of ionic strength and temperature. Development of the formula in its present usable form would not have been possible except for the laboratory data, published by a number of chemists, on activity coefficients and ionization constants.

Langelier's original calculations[7] focused attention of water technologists on a mathematical method of expressing the determined variables in a water which govern $CaCO_3$ solution or precipitation. Although quite exact over a given range of values, the equations are somewhat difficult to derive and the interpretation is quite tedious. A simplified statement of the equation for a pH range of 6.5 to 9.5 is:

$pH_s = (pK_2' - pK_s') + pCa + pAlk.$

where

pH_s is pH, water in equilibrium with $CaCO_3$.

pK_2' and pK_s' are logarithms of apparent constants computed from the true thermodynamic constants K_2 and K_s, which have determined values.

K_2 is the second dissociation constant for carbonic acid and K_s is the activity product of calcium carbonate. The value $(K_2' - K_s')$ varies with ionic strength, dissolved solids and temperature.

pCa is the negative logarithm of the calcium ion concentration in mols per liter.

pAlk. is the negative logarithm of the total alkalinity to methyl orange in terms of titratable equivalents per liter.

Larson and Buswell[8] used somewhat more recent and exact data for evaluation of the constants and their variation with total dissolved solids and temperature. Their revised formula for the pH of calcium carbonate saturation is:

$$pH_s = \log \frac{K_s}{K_2} - \log Ca^{++} - \log Alky. + 9.30 + \frac{2.5\sqrt{\mu}}{1 + 5.3\sqrt{\mu} + 5.5\mu}$$

K_s = activity product constant of $CaCO_3$

K_2 = activity constant for second dissociation of H_2CO_3

Ca^{++} = calcium, p.p.m.

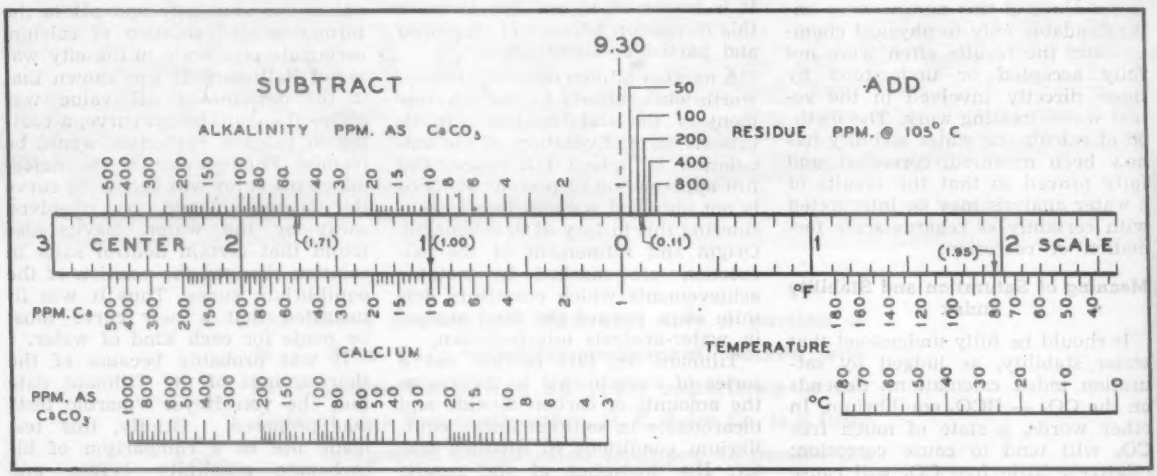
Alky. = alkalinity, p.p.m. as $CaCO_3$

μ = ionic strength = (residue on evaporation, p.p.m. at 105° C. × 0.000025) approx.

The "Calcium Carbonate Saturation Index" was originally suggested by Langelier[7] as the algebraic difference between the actual pH of a water and its calculated pH_s. This is actually the logarithm of the degree of carbonate saturation.

There are a number of methods for pH determination, any of which may be used in the field:

1. **Test strips.** The test is made



DIRECTIONS: To 9.30 add the sum of the scale values opposite the residue and the temperature figures. From this subtract the sum of the scale values corresponding to the calcium and the alkalinity.

EXAMPLE: Given Ca = 10 p.p.m., Alky. = 50 p.p.m. as $CaCO_3$, Temperature = 80° F., Residue = 200 p.p.m.; find pH.

SOLUTION: From point representing 10 p.p.m. Ca read upward in center scale to find value of 1.00; downward from 50 p.p.m. alkalinity in center scale to find 1.71; upward from 80° F. temperature in center scale for 1.96; downward from residue of 200 p.p.m. in center scale value of 0.11. Subtract and add these values to 9.3, as stated in "Directions," to get:

$$pH = 9.30 + (0.11 + 1.96) - (1.00 + 1.71) = 7.66$$

SIGNIFICANCE: When pH < pH_s undersaturated; corrosive tendency
pH = pH_s stable
pH > pH_s supersaturated; scale-forming tendency

Fig. 1—Scalar diagram for determining pHs or stability index of water. Arrows point to scale values used in example. (From A. A. Hirsch, Jour. Am. Water Works Assoc., Vol. 35, p. 595, 1943)

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by immersing the test strip in the water to be tested and comparing the resultant color with standards provided. Usually accurate to ±0.5 pH.

2. **Liquid pH indicators.** The test is made by adding a drop of the test indicator to the sample and comparing the color with standards. Accuracy is about plus or minus 0.5 pH.

3. **Slide comparator.** The water must be free of suspended matter and not too highly colored. Test is made by adding indicator to a vial of the sample and comparing with standards on a slide. Color of original sample is somewhat compensated for by using a "blank," containing no indicator, on either side of the sample. Accuracy is ±0.2 pH under ideal conditions.

4. **Glass electrode.** This instrument really consists of a glass electrode and a calomel electrode. The test is made by immersing both electrodes in the sample and measuring flow of current by a galvanometer. The galvanometer is usually equipped with a scale for direct pH reading. This is the most accurate method and determinations are usually accurate to plus or minus 0.1 pH even in highly colored or turbid waters.

In addition to pH value, three things must be determined before the stability index may be calculated:

1. **Ca, as $CaCO_3$.** Calcium is determined turbidimetrically, by weighing as CaO, or titrating with standard permanganate.

2. **Total alkalinity as $CaCO_3$.** Determined by titrating with standard acid in presence of methyl orange indicator.

3. **Total solids.** May be determined by evaporation at 105° C. and weighing, or by making complete analysis and using summation of determined constituents. Total dissolved solids is best determined in the field by using conductivity method. Several makes of instruments are available for this purpose.

As previously stated, the stability index is determined as follows:

Stability index = actual pH — pH_s

A plus value indicates a tendency to deposit $CaCO_3$, and a minus value a tendency to dissolve $CaCO_3$. Difference between the actual pH and the calculated pH of a water indicates the degree of stability. An example is given below, using the water from Anchor Gasoline Corp. water wells at its gasoline plant at Eola, La.:

Water wells, ft. deep	150
Ca, as $CaCO_3$, p.p.m.	192
Total alkalinity, as $CaCO_3$, p.p.m.	208
Total solids, p.p.m.	369
pH value (determined)	7.3

Using these values, the pH_s and stability index may be calculated. Use of Langelier's formula requires considerable study and time in actual calculation. After study of the derivation and becoming used to reference to tables for values of pK_2' and pK_s', the calculation may be made for one temperature in about 1 hour.

Scalar Diagram Provides Rapid Computation

Several devices based on Langelier's formulas, have recently appeared to facilitate the calculation of the stability index. A nomogram was suggested by Hoover,[9] and Hirsch[10] devised a slide rule A still more recent scalar diagram by Hirsch[11] is reproduced in Fig. 1. This diagram has been found a useful and practical tool, since it speeds up a rather accurate application of the Langelier formula to the interpretation of a water analysis.

It will be noted in the example that all values are found on the center scale (A — B). Zero on this scale has numerical value of 9.30. Scale values to the right are added and scale values to the left are subtracted from 9.30 to find pH_s. Temperatures for both Centigrade and Fahrenheit are shown for convenience. It will be noted also that scales are included for both calcium and calcium carbonate. If a water analysis happens to be reported in terms of $CaCO_3$ it is much quicker to read from the $CaCO_3$ scale rather than divide by 2.5 to convert to Ca.

The following values for pH_s and stability index were obtained on the water from Anchor Gasoline Corp. wells in 5 minutes by use of the scalar diagram:

Temperature	pH value determined	pH_s	Stability index (actual pH — pH_s)	Interpretation
65° F.	7.3	7.4	—0.1	Very slightly corrosive
100° F.	7.3	7.1	+0.3	Very slightly scale forming
150° F.	7.3	6.7	+0.6	Slightly scale forming
200° F.	7.3	6.3	+1.0	Scale forming

A chart of these values, Fig. 2, shows that this water is neither corrosive nor scale forming at 70° F.

The index may not indicate if a given state of supersaturation will be great enough to produce a precipitate or if such precipitate will form a protective film. This is especially true if plus values are small in a pH range near neutrality. For this reason, Ryznar[12] has suggested a slight change in the numerical statement of stability index values. It is claimed that twice the calculated pH minus the actual pH will give a more accurate expression of whether scale formation or corrosion is to be expected. Hammerschmidt[13] has recently applied the Ryznar stability index to the control of compressor cooling water. There are at present only two remaining deficiencies in the methods of stability index calculations. Where a water is subject to lime-soda ash softening, it is possible that the equilibrium values for $Mg(OH)_2$ should receive consideration. Also, the calculations take no note of the oxygen factor. It is entirely possible for a water to be scale forming and yet corrosive due to dissolved oxygen. In such cases a little extra study of prevailing operating conditions will usually reveal the troublesome factor as well as necessary corrective measures.

It is necessary to become accustomed to the index and its significance when applied to various types of water and conditions. A subsequent article will deal with applications of stability-index calculations. Examples will be given of scale formation and corrosion and successful correction of these conditions based on stability index.

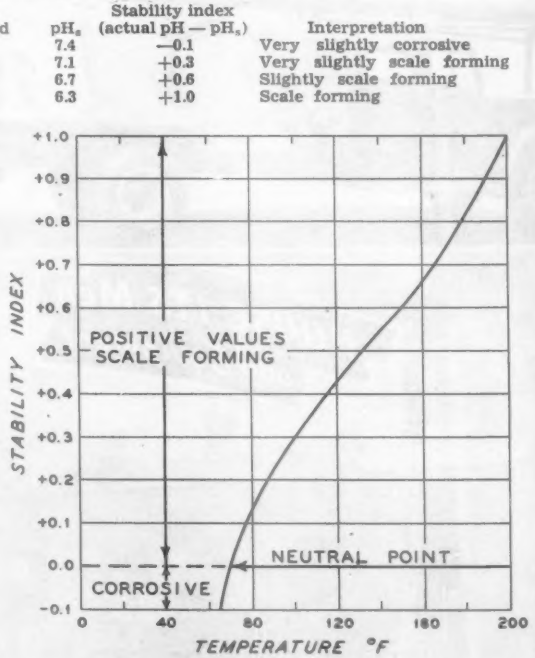

Fig. 2—Stability at different temperatures. Water from wells at 150 ft. Anchor Gasoline Corp., Eola, La.

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Caliper for Inspecting Tubing Has Four Distinct Advantages

THE alternating-current caliper pictured here is an inspection instrument for determining the point of marginal economy and safety in the life of high-pressure tubing which is subject to internal corrosion—specifically, of cracking-still tubes. The caliper was developed by I. S. Roberts.

It comprises a measuring head weighing about 3 lb. which is connected electrically to a small portable meter box. The assembly plugs into an alternating-current lighting circuit. The measuring head is arranged for lowering through vertical tubes or for pushing through horizontal tubes. Pivoted fingers which extend from the measuring head and continuously contact the inside surface of the tube which is being inspected also position the core of the solenoid coil inside of the head and thus fix its inductive reactance. This is indicated by the meter and is read in terms of the corresponding inside tube diameter. The caliper is accurate to ± 0.01 in.

In operation an assistant passes the measuring head rapidly through successive tubes while the inspector stands nearby to read and record their maximum inside diameters or other desired measurements.

This instrument is believed to have the following advantages: (1) The measuring head is light and can be operated quickly and without fatigue. Indications are nearly instantaneous. (2) The caliper provides a continuous indication of inside diameters rather than a series of spot measurements and it is therefore unlikely that any critical points might be missed. (3) The measuring head contains no intricate or delicate mechanisms which might be adversely affected by rough treatment, heat or abrasive dust. (4) There is no switch, slide wire resistance or other device inside the measuring head which might cause a hazardous electric spark.

Howard W. Folkers, geologist for Colombian-Gulf Oil Co., has arrived in Bogota where company headquarters have been established. He was formerly geologist for Gulf Oil Corp. at Fort Stockton, Tex.

This illustration shows a typical Daniel Check Valve installation on Compressor Discharge lines. These Daniel Check Valves have been giving dependable, trouble-free service for over five years in this, one of the first large re-cycling plants to be built. In addition, Daniel Check Valves are recommended for use on Input or Injection wells.

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QUESTIONS on TECHNOLOGY

by **W. L. Nelson**
Consulting Engineer

Difference Between Coal Oil and Kerosene

What is the difference between coal oil and kerosene?—R.A.B.

To our knowledge the terms kerosene and coal oil are today used synonymously, the preferred name for burning oils, lamp oils, etc., being kerosene. The term "coal oil" is a colloquialism used mainly in rural districts. A little history may clarify the situation and indicate how the name coal oil originated. In the years prior to 1859 (date of the Drake discovery well) many plants were in operation for the destructive distillation of coal. Some 60 of these plants were in operation during the years 1852-1859. The coal oil produced in these plants burned with a somewhat smoky flame and hence the highest-quality burning oils were seal oil and sperm oil. The discovery of petroleum afforded an excellent burning oil except for the tendency to leave too much gasoline (or naphtha) in the burning oil, and hence the coal-oil plants were converted into plants for refining petroleum. Competition with sperm and seal oil resulted in the names mineral seal oil or mineral sperm oil which persist even today in Federal Specifications. A New York chemist by the name of Gessner, originated the name kerosene from the Greek word "keros" meaning wax and "sene" meaning light, and the name kerosene was licensed in the year 1857 to one of the large coal-oil operators, who then called his firm Downer Kerosene Oil Co. The name "coal oil" has persisted since 1860 even though coal has not been used since that time for the manufacture of illuminating oils.

Minimum Carbon-Black Plant

We are planning on removing the gasoline from 5,000,000 cu. ft. of very wet gas, and possibly burn the dry gas in a carbon-black plant. How small a carbon-black plant is practical and advise what yield of carbon black is reasonable.—W.R.N.

The average size of carbon-black plants is about 15,000,000 cu. ft. per day and the average yield is about 1.5 lb. of carbon black per 1,000 cu. ft. of gas. Yields of 1.9 lb. of black per 1,000 cu. ft. have been reported and with a very rich gas it is quite possible that yields of 2.5 or 3 lb. per 1,000 cu. ft. might be attained by the conventional channel process.

The collection and bagging of carbon black is a somewhat complicated operation and hence it is doubtful if a 5,000,000-cu.-ft. plant would be economical, particularly if the field or gas supply is not adequate for 10 or 15 years of production. In contemplating such a venture the position of processes for the manufacture of thermal black, furnace black, and lampblack should not be overlooked. Refer to the two excellent articles by J. F. Gallie of the Natural Gas & Natural Gasoline division of Petroleum Administration for War (Refiner, March-April 1944) and to "Protective and Decorative Coatings," Vol. II, a book by Mattiello, John Wiley & Sons, Inc., 1942.

In 1941 there were 28 carbon-black plants in the Panhandle Texas field. The average capacity was about 32 million cubic feet per day. Only two plants were smaller than 5 million and one of these was so small (320,000 cu. ft.) that it was probably not in full or conventional operation.

Copper-Base Alloys for Petroleum Industry

We have a copper-base alloy which we think is particularly adapted to requirements of the petroleum industry for such services as valves, pumps, reaction chambers, etc., especially for West Texas crude oils. Can you outline for us or direct us to the applications of such an alloy to the industry, or in other words, assist us in amplifying our knowledge?—J.R.R.

The possibility of using copper-base alloys for such a service as reaction chambers appears to be remote. Nevertheless, there are numerous applications for such alloys in the industry. The general subject is so complicated that a detailed discussion cannot be given here but the following are the main applications at the present time. Each application is followed by a series of reference numbers which may be found at the end of this discussion. All of the references except the first six are taken from The Oil and Gas Journal (Progress in Metals page, etc.) and hence the magazine name is not repeated, only the page and date are recorded. The relative importance of each of the applications can be judged somewhat by the number of references that appear.

Condenser and exchanger tubing—1, 2, 3, 4, 5, 6, 13, 14, 16, and 18.
Pump parts—10 and 12.
Tube sheets and baffle plates—4 and 5.
Polished rods, balls and seats—9 and 15.
Oil-burner tubing—11.
Valve parts—12.
Acid-treating lines—4.
Bolting and woodscrews—4.
Sucker rods—7.
Meters and instruments—8.

1. Moore & Kleinheksel—"Testing of Nonferrous Alloys for Condenser-Tube Service Under Conditions Simulating Actual Industrial Service," 10th Midyear Meeting A.P.I., Fort Worth, May 29, 1940.

2. Barry, F. M.—"Testing of Brass Alloys for Dezincification Resistance," 10th Midyear Meeting A.P.I., Fort Worth, May 29, 1940.

3. Wilkins, Bunn & Lynes—"Corrosion of Copper-Base Tubing in Oil-Refinery Heat-Transfer Equipment," 10th Midyear Meeting A.P.I., Fort Worth, May 29, 1940.

4. Kemp, James T.—"Copper Alloys and Their Application in Petroleum Refining," 10th Midyear Meeting A.P.I., Fort Worth, May 29, 1940.

5. Nelson, W. L.—Petroleum Refinery Engineering, 2nd Ed., p. 263 and p. 397, McGraw-Hill Book Co., New York.

6. Mitchell, N. W.—"Corrosion of Tubing in the Oil Industry," Western Petroleum Refiners Association Meeting, Fort Worth, Oct. 27, 1936.

7. "Copper-Alloy Sucker Rods," p. 65, Aug. 15, 1940.

8. "Metals in Production—Miscellaneous," p. 70, June 13, 1940.

9. "Metals in Production — Balls, Seats and Polished Rods," p. 92, April 11, 1940.

10. "Metals in Drilling," p. 58, Aug. 10, 1939.

11. "Use of Copper Alloys," p. 46, Sept. 29, 1938.

12. "Metals Used in Pipe Line Construction and Operation," p. 65, June 39, 1938.

13. "Service Conditions Determine Type Alloy or Steel Used in Refinery," p. 68, April 28, 1938.

14. "Admiralty Metal Tubes Excel," p. 100, March 17, 1938.

15. "Role of Metals in Pumping and Lifting Oil," p. 144, Feb. 24, 1938.

16. "New Condenser-Tube Alloys," p. 54, Dec. 4, 1941.

17. "Save Tin by Use of Aluminum Bronze," p. 53, Feb. 18, 1943.

18. "Hazards and Corrosion with Sour Crudes," p. 107, Dec. 16, 1944.

The Acrylic Resins—Derivatives of Petroleum

by John D. Constance

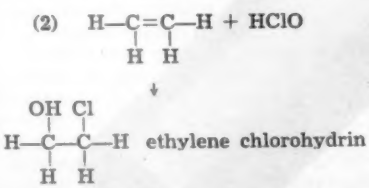
ONE of the indications that petroleum is becoming the center of a great chemical industry is that it is producing all manner of useful materials not previously associated with it. Among these materials developed is methyl methacrylate resin. Basically derivable from petroleum, the resin is one of the most important plastics yet discovered. Methacrylic acid and some of its derivatives are not new, but it was not long ago that recognition of the rather unusual properties of the methacrylic ester polymers stimulated research which led to their commercial development.

Only as far back as 1931 acrylic resins made their first appearance and were made in commercial quantities. Although acrylic acid derivatives had been experimented with before 1900, it was not until 1901 that more than general interest was given them after experimental research data were published by Dr. Otto Rohm, of Darmstadt, Germany.

The polymerization products of monomeric derivatives of acrylic acid are the acrylic and methacrylic resins. The esters of the acrylic and methacrylic acids are of the greatest importance from the commercial standpoint. The esters when polymerized form thermoplastic resins and in that form possess unusual characteristics. The demand by many industries for these thermoplastic resins is tremendous. The processing of methyl methacrylate resin into granular molding powders has opened an enormous market for their use in thermoplastic moulding.

Acrylic acid has the structural formula $CH_2=CH—COOH$; and for its delivative, methacrylic acid, $CH_2=C(CH_3)—COOH$. The various steps in the synthesis of methyl acrylate resin are as follows: Ethylene produced by the high-temperature cracking of petroleum is chlorinated by passing ethylene gas and chlorine gas simultaneously into water. The ethylene chlorohydrin that is produced is soluble in the water and may be removed by distillation. The chemical reaction may be considered as composed of two steps:

(1) $Cl_2 + H_2O \rightarrow HCl + HClO$

(2)


The ethylene chlorohydrin reacting with sodium cyanide in a following reaction:

(3) $CH_2\,OH{\cdot}CH_2Cl + NaCN \rightarrow CH_2\,OH{\cdot}CH_2CN + NaCl$

The author, now associated with Air Reduction Co. as chemical engineer, spent 5 years in the heat-exchanger and refrigeration industries, and 2 years with Combustion Engineering Co. He then joined E. B. Badger & Sons Co. in the New York petroleum division where he assisted in the engineering design of the Russian oil refineries that company was handling. Constance instructs an evening class in a review of the practical applications of chemical engineering at the Engineering Societies Building in New York, given under the sponsorship of the A.S.M.E. He is a licensed engineer and a member of the National Society of Professional Engineers.

Then

(4) $CH_2OH{\cdot}CH_2CN + ROH + H_2SO_4 \rightarrow CH_2=CH—COOR + NH_4SO_4$,

giving us the acrylic acid esters, $CH_2=CH—COOR$.

The methacrylic acid esters can be synthesized by the dehydrohalogenation of alpha or beta halogenated isobutyric esters:

$$(CH_3)\ CCl\ COOR \rightarrow CH_2=CCH_2COOR + HCl$$

Polymerization

Catalysis plays an important part in the polymerization of both acrylic and methacrylic esters. Heat, light, oxygen and oxygen-yielding substances such as sodium peroxide, hydrogen peroxide and benzoyl peroxide are the catalysts most commonly used.

Physical Characteristics

Methacrylate esters may be polymerized directly, in a cast, into solid, glass-like resins. Molds which have been designed and shaped previously give the shapes desired. On the other hand, the esters may be polymerized in finely divided powder form and molded into any desired shape in a manner suitable for a thermoplastic resin. The resins are all clear water-white and are not affected by light or age and unlike certain other resins will not turn yellow under direct sunlight.

The amazing light-carrying ability of this polymeric resin is only rivaled by the ease with which it can take on colors and become pigmented. This light-weight material is tough and highly resistant to outdoor exposure.

Commercial Applications

Because of its transparency, strength, high softening temperature, low specific gravity and chemical resistance this resin has enjoyed outstanding success in the plastics industry. Its value is increased because of the ease with which it may be molded. Either the mold or cast forms may be readily worked, sawed, cut, blanked, turned in a lathe, drilled, formed, ground-polished and sanded similar to the nitrocellulose plastics. At 221° F. the sheet forms become soft enough for general shaping. For more rigorous shaping a temperature of 400° F. is necessary. The preparation of the sheets for shaping is done in air ovens to provide uniform heating. Forms made of wood and metal are used and may be removed when the temperature has dropped to 175° F. At this temperature the material will hold its shape.

The acrylic resins are used widely as binders for wood, metal, textiles, rubber, glass, and other materials. Their use offers complete freedom from bacterial and fungus deterioration and the bond so made is transparent and colorless. Because of its elasticity and extensibility, it finds use in bonded assemblies which undergo flexure and elongation.

Commercial Uses

These acrylic resins have found extensive use and successful application in the automotive industry where they make up exterior parts such as radiator ornaments and directional-signal lenses. Their toughness and ease of working have placed them high on the ordering lists of manufacturing concerns making musical instruments, kitchenware, combs, brushes, mirrors, costume jewelry, and cigarette cases. The refrigerator industry is using these resins and assembling their new refrigerators with their molded panels in doors and drawers.

These are but a few of the present applications possessed by the acrylic resins. Hundreds more are in daily use and new developments are moving forward rapidly.

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DRILLING-MUD PROBLEMS—With Suggested Solutions for Several Types

by R. E. Dansby

This article completes a discussion begun in last week's issue, in which the author takes up in detail the various drilling-mud problems, and presents some suggested solutions for each type of problem. Dansby is head of Dansby Mud Engineering Service, Houston, and is a top-ranking authority on the subject of drilling mud. An article in the June 9 issue of the Journal by Dansby related how mud programs aid in economical and efficient drilling.

Gas-Cut Mud

WHEN the problem of gas-cut mud is encountered it is advisable to maintain a low-viscosity and low-gel-strength mud and to raise the mud weight sufficiently to prevent the entrance of gas into the hole, agitating the mud and treating it to reduce the gel strength to permit the gas to break out of the mud. Signs of this condition are usually as follows:

1. Increase of the flow from the well, or an increase in the volume of mud in the pit. (If very large volumes of mud or gas are coming out, it may not be noticed until the mud begins to kick over the blow-out preventer, but this should never happen, because it should have been noted by an increase of the fluid in the pit.)
2. Upon close examination minute gas bubbles which do not break out readily, show up in the mud.
3. An odor of gas at the flow line.
4. Uneven flow of mud from well. (Gas pockets cause mud to flow by heads.)
5. Distillate forms emulsion with the mud, and will be shown by ineffectiveness of chemical treatment.

The following steps are recommended to stop the gas kick: At the first sign that the hole is unloading, close the well in and regulate chokes and pumps to stop unloading, and at the same time start increasing the density of the mud and continue this increase until the gas quits coming into the hole. If the mud starts losing to the formation, decrease the addition of weighting material or put the well on a larger choke, or slow the pump down. If losses are extreme, start the addition of fibrous material and bentonitic-type clay to stop loss. The clay alone will often do this without the necessity of a fibrous material.

If the well is making only a slight amount of gas, the above will not be necessary, but mud guns must be put on the pit and the viscosity of the mud reduced to break all of the entrained gas from the mud. If possible never recirculate gas-cut mud into the hole. During all of these steps a careful check should be kept on the volume of the mud in the pit.

The best solution to gas cutting as well as all other troubles with mud is immediate action. Delay in increasing mud weights permits entrance of more gas into the hole as well as the recirculation of the gas-cut mud. If the gas-cut mud is circulated and gas is still breaking in from the formation on the second or third circulation, the gas may reduce the density of the mud sufficiently to allow fluids or gases from all exposed formations to flow into the hole and probably a blowout will result.

Cases in which the gas does not readily break out of the mud when the viscosity is reduced and the mud is agitated are the most dangerous conditions with gas-cut mud.

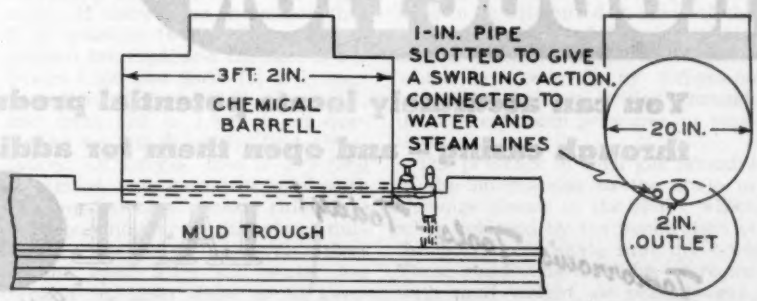
Dry gas readily breaks out of the mud at the shale shaker, after the viscosity has been reduced with the SAPP treatment. However, so-called wet gases or gases with high liquid-hydrocarbon content are usually very hard to remove from the mud and in some cases will be unknowingly recirculated. This fortunately is an unusual condition.

This situation is easily noted if the mud is picked up and permitted to spread on the hand or poured on a board or other flat surface. Close observation will immediately reveal hundreds of very fine boiling gas bubbles. Always make this test when mud is gas cutting. This condition should be revealed if a recording mud-weighing instrument is being used. However, due to adding weighting material during one of these conditions, it may not be shown with mud weight.

There are a number of mechanical degassers which have been used by various operators with varying degrees of success. The most effective degasser noted to date, other than centrifuging, is the regular oil and gas separator placed 30 ft. off the ground, operated with a vacuum developed by steam jets. This is an elaborate system and not necessary except in extreme cases. Although mechanical degassers are effective, it has been found that the following chemical treatments are effective and less expensive for removing distillate from the mud:

Using a chemical treating barrel illustrated in Fig. 1, 50 lb. of caustic is dissolved in 20 gal. of water, 100 lb. of quebracho is added to this water while agitating, and another 12 to 20 gal. of water added. One hundred pounds of bentonite is next added and the barrel filled with water. This solution is then boiled with steam for several minutes, until the bentonite is dispersed and the quebracho is thoroughly mixed. Add slowly to the mud stream while the solution is still boiling. Distillate breaking out of the mud will be noted, and tests below the shale shaker usually indicate that the gas has been removed.

The SAPP treatment is not as effective after the caustic and quebracho, or quebracho alone, is added to the mud, as it is on the mud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MUD TROUGH
2IN. OUTLET

Fig. 1—Mud-treating-chemical barrel. The swirling action expedites mixing

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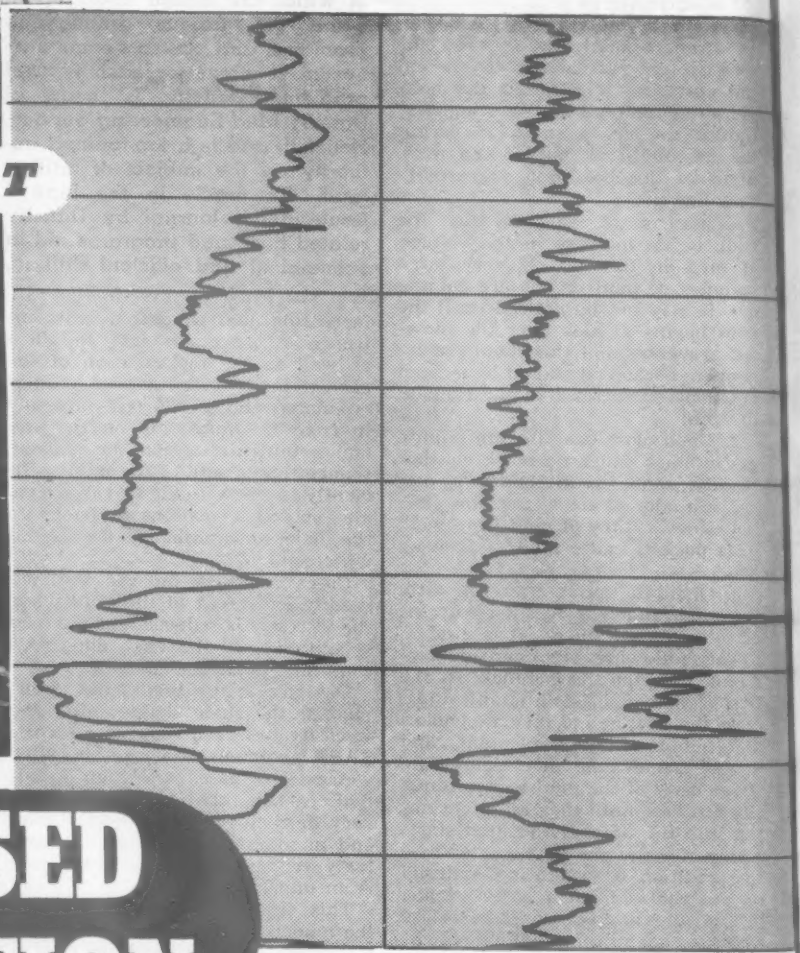

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that has nothing but SAPP in it, therefore do not use this treatment unless absolutely necessary.

One cubic foot of gas at 10,000 ft. moves up the hole slowly and expands at a very slow rate at first. At 1,250 ft. from the surface this gas occupies a volume of 8 cu. ft., and is rising and expanding at a much higher rate of speed. At 625 ft. it will occupy 16 cu. ft., or approximately 80 lineal feet of 7-in. casing. Prior to this time mud undoubtedly would have been pushed out of the hole, and the upward travel and expansion of the gas would be exceedingly rapid. When all of the fluid ahead of the gas has been expelled from the casing, the rate of travel and expansion of the gas would be in the nature of an explosion. Conditions change so rapidly after the gas starts flowing out of the hole that there is usually a very short time interval in which to close valves or blowout preventers but by close observation of the pit level, when drilling a deep well, the entrance of gas can be noted as much as an hour or an hour and a half before it reaches the surface.

Salt-Water-Contaminated Muds

The following steps are recommended for salt-water-contaminated muds: First, stop salt increase, if possible, by increasing mud weight, closing well in on chokes, or both; second, treat muds heavily with caustic and quebracho as soon as salt increases are noted; third, dissolve 50 lb. of caustic in 15 gal. of water in the regular chemical treating barrel. Slowly stir in 100 lb. of quebracho and finish filling the 50-gal. barrel with water; and fourth, add sufficient chemicals to prevent decrease in pH of the mud.

Salt-water flows are usually noted in the following manner: An increase of volume in the circulating system is definite proof that water or gas is flowing into the hole. If there is doubt as to whether or not the volume of mud in the suction pit is increasing, the pumps should be shut down, and if water or gas is flowing into the hole the mud will continue to flow from the flow line.

An increase in salt content of mud can be easily determined by titration for NaCl.

Usually the first visual effect of salt contamination of the mud is increased gel rate and viscosity. After several hours of circulation, viscosity will drop, and probably go down to the viscosity of a brine water because mud solids are settled out. With a small per cent of salt increase it may be necessary to determine increased gel rate and viscosity by tests.

Such salt contamination tends to sharply increase water loss, a condition which should be detected at once and the mud treated to prevent the loss. The following are a few treatments or solutions for salt-water problems:

If possible keep the water confined to the formation. It is never excusable to release a water flow unless there are definite signs that the casing will not stand the pressure, or that there is insufficient casing in the hole to prevent the mud from breaking into surface formations. This can be done in several ways. The well can be closed in and put on proper choke; that is, the mud is permitted to flow at the same rate it is being pumped, or the mud weight should be raised uniformly, and as rapidly as possible, until the water is held in the formation.

Always watch closely for loss or gain of mud. Add weighting material uniformly; do not slug it. Stop increasing the weight or put the well on larger chokes or slow the pumps down if the mud is being lost to the formation, even though the flow of water continues. Add a bentonitic-type clay and if this is not effective add a fibrous material also, until the hole is walled sufficiently to stop the loss. If the pit is still gaining the well is on too large a choke or the pump is running too slow, or insufficient weighting material is being added.

The mud should be treated immediately with strong concentrations of caustic soda and quebracho, if there is an indication of water flow, even though the water or contaminated mud has not reached the surface. This treatment is necessary to prevent flocculation of the mud by the water that broke in before the well was closed in. Various concentrations of caustic and quebracho may be used but experience has shown the following to be effective: 50 lb. of caustic is dissolved in water, and then 100 lb. of quebracho is added while stirring and filling the 50-gal. drum with water. Add this solution rapidly to the mud, even though it causes a high gel which prevents the mud from flowing readily in the ditch, or through the shale shaker. After it goes through the pumps, and possibly the hole, for vigorous agitation, the viscosity will likely be less than it was originally. If there is an indication that 8, or possibly 10 bbl. of water has entered the mud, and the hole is between 7,000 and 9,000 ft., it is suggested that 300 to 500 lb. of caustic, and from 600 to 1,000 lb. of quebracho be added on the first circulation. Of course, this is a strong treatment, and should be used with caution, but as a general rule there is more tendency to undertreat during the first two or three circulations of the mud, after salt water has broken in, than there is to overtreat. A good rule is to add as much chemical as possible to the mud and still be able to get the mud through the shale shakers. After this, add sufficient caustic and quebracho solution to prevent the pH from decreasing, or in some cases it is permissible and advisable to raise the pH 0.1 or 0.2 to be sure that the salt is not decreasing it. This treatment is good only for low concentrations of salt; it ceases to be effective when the salt concentration reaches 2 per cent. It should prevent increases in water loss. Special treatments are necessary for over 2 per cent NaCl.

Heaving Shale

The expression "heaving shale" is probably the most overworked term in oil well drilling. It is often used to describe any trouble while drilling a well. It is ambiguous and is often a bugaboo which frightens some individuals unnecessarily.

Improvement in drilling technique has eliminated many of the problems that were formerly attributed to heaving shale. Most of the so-called heaving shale is caused by an entrance of a flocculating agent into the mud such as cement, salt, salt water, anhydrite, or gypsum, which destroys the wall-building properties of the mud.

Cuttings not being washed out of the hole is probably another condition responsible for a large percentage of this so-called trouble. This can be due to several things, probably the most common of which is making hole faster than the cuttings can be washed out or maintaining insufficient pump capacity. This is very evident in holes deeper than 12,000 ft.

Hole enlargement, which has been shown by caliper surveys, is another condition known to exist. Cuttings certainly stop in such enlargements and if permitted to stay there will form a bridge. This can be demonstrated in many ways. For example, this is illustrated when using an ordinary Le Chatelier flask to determine the specific gravity of weighting material. In filling the flask with the heavy weighting material, if a few particles start collecting in the enlargement, a bridge is formed immediately.

There are other cases of shale causing troubles which probably have to be attributed to some of the so-called causes of heaving shale, such as internal stresses in the shale which are relieved by expansion when the hole is drilled through them, overburden pressures, or plastic flow.

The presence of high gas pressure in the laminations in the shale or cleavage planes in the shale, which when released by the penetration of the bit, forces shale into the hole. These conditions must be overcome with mud weight, or possibly controlled back pressure.

The presence of so-called benton-

itic shales, which take up water from the mud and swell with sufficient pressure to push the shale into the hole, is another probable cause of heaving shale.

There have been many different methods tested for drilling what is termed heaving shale, but as a general rule the most successful method has been to use good drilling practice, maintaining a low-water-loss mud; that is, treating to counteract electrolytes which cause flocculation of the mud and maintain a mud weight which supplies sufficient hydrostatic pressure to hold some of the troublesome shales in place. It seems that in cases where a shale starts to heave, and salt, salt water, anhydrite, or cement have not destroyed the mud, it is advisable to use 17.0 to 17.5-lb.-per-gal. mud.

Specialized muds such as sodium silicate, oil base, starch, and high-pH muds have either been successful or are considered as practical for drilling heaving shale. If bad shale conditions are known to exist and natural mud is giving trouble, then one of the special muds should be carefully considered.

As mentioned above, some heaving shale can be prevented by following a few simple precautions while drilling, such as being careful not to make more hole than the pumps are capable of washing out; finding out the trouble if cuttings fail to come out while drilling; if drill pipe gets tight, work pipe slowly up and down; hard pulling when pipe is binding with collection of cuttings, or extreme pump pressure aggravates the condition. Precaution should be taken when making trips to prevent tearing up mud walls, to prevent pulling drill pipe into bridges, or to prevent reducing the hydrostatic mud pressure by swabbing action or otherwise. That is to say, if the hole is swabbing or the drill pipe tends to drag or stick either in going in or coming out of the hole, stop the pipe and clear the hole up either by pumping or reaming or both.

Maintaining a Mud While Drilling Salt Beds, Anhydrite, or Gypsum

In drilling limestone, calcareous shale, anhydrite, gypsum, and other formations containing soluble calcium salts, the colloidal clay in the mud will be flocculated. Of course, in drilling salt beds, all of the colloidal clay will be flocculated unless special treatments are used. The calcium-bearing minerals, chiefly calcium carbonate and calcium sulfate, are not readily soluble in water, but are sufficiently soluble to alter seriously the properties of an ordinary fresh-water-base mud.

If a formation containing large amounts of soluble calcium salts is suddenly encountered when using a mud containing an appreciable concentration of completely hydrated sodium bentonite, the clay is flocculated because the calcium replaces the sodium of the clay particle. This condition is readily observed by noting a rapid increase in the gel rate, high ultimate gel strength, high viscosity, and greatly increased water loss.

The same general treatment, that is, starch-treated muds, appears at present to be an effective and economical method, both for drilling the salt beds and the calcium-bearing formations. However, recently very good results have been obtained using a product called Anhydrox for gypsum and anhydrite where muds were not previously treated with phosphates.

In drilling salt beds, it has been the practice of most operators to set casing on top of the salt and through the salt. Much casing has been saved recently by treating mud with starch. The mud should be saturated with salt before drilling any salt bed, to prevent washing out great cavities. A salt-resisting colloidal clay should be used in conjunction with starch in salt muds, to increase viscosity. With starch treatment of brine muds, it is possible to obtain a water loss of less than 1 cc/30 minutues. Saturated brine

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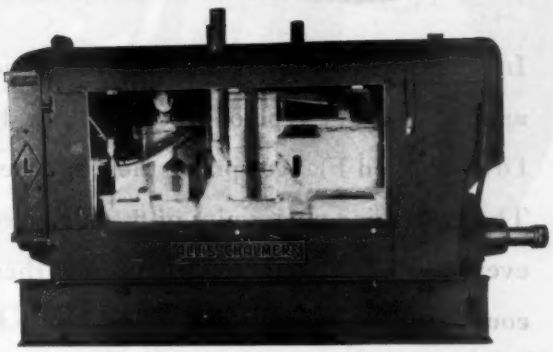

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will prevent the starch from fermenting, hence it is not necessary to raise the pH of salt-starch muds.

Many mud treatments have been tried for drilling anhydrite and gypsum, with varying degrees of success, such as heavy treatments with soda ash and colloidal clays. Recently considerable success has been obtained in treating anhydrite-contaminated muds with Anhydrox. Also starch muds have been very successful in drilling this type of formation. Anhydrite increases the water loss of the mud and causes other sections of the hole, either above or below the anhydrite section, to cave. It is definitely necessary that the pH of a fresh water mud be increased to 11.5 or above, before starch is added, to prevent fermentation. The amount of starch necessary is determined by running pilot tests on the mud to obtain the desired water loss. The amount of starch needed will range from 7 lb. to possibly 20 lb. per barrel of mud.

Cement-Contaminated Muds

It is extremely important in any drilling or workover well to correct cement contamination with cement, the viscosity and gel properties increase markedly, and wall-building properties of the mud are destroyed if the mud is not treated. Generally, the effect is more pronounced if the cement is not set thoroughly, or if the plug leaves cement in the casing as it is being pumped down. More contamination occurs in drilling the cement out of the pipe when the plug stops high. In the case of set cement, contamination increases with the fineness of the ground particle, varying from less contamination with coarse bit cuttings, to greatest contamination where the material is finely ground.

The increased viscosity and poor wall-building properties of cement-cut mud can be attributed to flocculation of clay colloids by calcium hydroxide, $Ca(OH)_2$, in the cement slurry. The calcium hydroxide is alkaline, and will cause a rise in the pH value of the mud. Some of the articles written on mud advance the theory, and some operators still subscribe to it, that it is necessary to permit the cement to flocculate and remove the colloidal clay from the mud, and then treat, to counteract the calcium hydroxide and replace the colloids with new clay, but this is definitely incorrect, the mud can be treated to prevent flocculation.

Cement contamination will be noted by increased gel rate and gel strength, increased pH, increased viscosity, and increased water loss.

The following chemical treatment is recommended: Mix 50 lb. of bicarbonate of soda in a 50-gal. drum of water and add to the mud at a high rate. It is estimated that 1 lb. of bicarbonate of soda will completely

counteract the effect of 1 lb. of calcium hydroxide dissolved in the mud. (Note: all cement is not dissolved in the mud; the shale shaker removes much of the cuttings.) Also, treat sufficiently and quickly enough to prevent increase in pH. The amount of chemical to use should be determined with many pH determinations.

For best results the mud which follows a cement plug should be treated heavily with sodium bicarbonate, in the pit, while cement is being mixed. If this is not done, any mud circulated out of the hole after a casing job should be thoroughly treated with bicarbonate before it reaches the pump.

It is possible to treat a cement-flocculated mud with sodium bicarbonate until the cement is counteracted, but if the mud has been permitted to flocculate, many of the colloids are lost and it is necessary to replace them with a bentonitic clay; under normal conditions this should never be permitted. If treated properly the pH does not increase and the water loss remains constant or decreases slightly.

If the above treatment is properly administered, the mud will become very thick and require raking in the ditch, and the shaker will require continuous cleaning to get the mud through the screen, but after it reaches the pumps, or is vigorously agitated, the viscosity will decrease.

Add all the water possible to the mud without decreasing the density. If all of this treatment is carried out properly, the pH and water loss will be down, but, if the viscosity is up, it is possible to follow this treatment with SAPP to reduce the viscosity. However, be sure that sufficient bicarbonate has been added before the SAPP treatment is started because they will tend to counteract each other.

Many mud-treating chemicals will reduce the viscosity of a cement-contaminated mud, but the only treatment observed by the author to date which will prevent flocculation and destruction of wall-building qualities, is treatment with bicarbonate of soda. Although there is evidence that in some cases if the mud is treated very heavily with tannates the same results may be obtained, it is doubtful that this procedure is nearly as successful, especially in long cement jobs, as the bicarbonate treatment of a low-pH mud.

It is often helpful and advisable, if other conditions permit, to drill the cement plug with water and discard this water. However, the expression is often heard that if the plug in the casing is drilled with water, cement will not bother the mud. This is never true. In the first place, the water will not wash all the cement out of the pipe, but probably more important is the fact that the plug, when pumped down, will leave much green unset cement in the mud in the casing, which will go to the pit and probably not be noticed until after it is recirculated and thoroughly mixed with the mud. This cement destroys more mud than does the drilling of plugs, because a great majority of the plug goes across the shale-shaker.

References

Cannon, George E.—"Changes in Hydrostatic Pressure Due to Withdrawing Drill Pipe From the Hole." A.P.I. Paper No. 901-10D.

Cheney, Preston E.—"A Review of Recent Advances in Drilling Mud Control," A.P.I. paper, presented November 10, 1942, Chicago.

Works, Madden T.—"Blowouts: Causes and Prevention," A.P.I. Paper No. 901-20D.

R. L. Holden, who was formerly drilling foreman for Ultramar in Argentina, recently arrived in Bogota, Colombia, and has joined Texas Petroleum Co. as field foreman.

W. Winans Freeman, vice president of Columbia Gas & Electric Corp., was elected a director to fill the vacancy caused by the recent death of Philip G. Gossler, chairman of the board. The office of chairman of the board was abolished.

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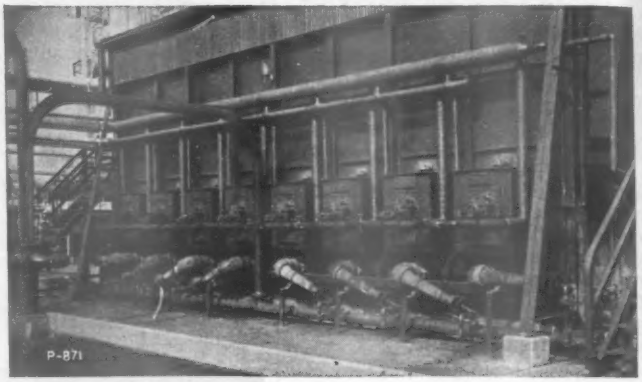

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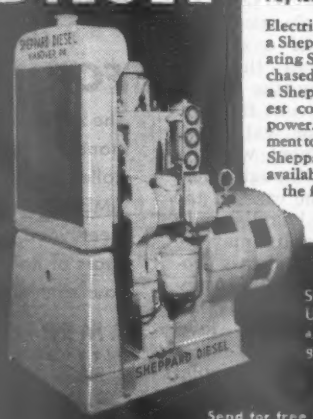

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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Vapor Volume and Mol Weight

THE volume occupied by a material when it is in the form of a vapor is related to the weight of the material by means of molecular or mol weight. Thus, 1 lb. molecular weight of a material will occupy 379 cu. ft. when in the vapor state, or in several common units:

Molecular wt. expressed in	Volume of vapor at std. conditions
pounds	379 cu.ft. @ 14.7 psia. & 60°F.
pounds	359 cu.ft. @ 760 mm. & 32°F.
grams	22.4 liters @ 760 mm. & 0°C.

If the gas or vapor is at some other temperature or pressure than the standard conditions shown above, it will occupy a different volume, as:

$$P V = n R T$$

in which:

P = pressure, psia.
V = volume, cu. ft.
T = absolute temperature (°F. + 460)
R = gas law constant = 10.73
n = number of pound mols

Note that it is not necessary to compute the volume of gas at standard conditions (i.e. number of mols times 379, 359, etc.) in using the above formula. The constant R is equal to 379 times 14.7 divided by (60 + 460) and hence the formula already contains the relationship between weight and volume. All materials do not behave exactly as the formula indicates but it has become common practice to use the formula for all refinery vapors unless the pressure is extremely high, as in the cracking coil of a cracking plant. Fig. 2 is a chart for solving the equation. (See next page.)

Molecular weight may be defined as the sum of the weights of the relative weights of the atoms that compose the molecule. The weights of common atoms are:

Hydrogen	1	Nitrogen	14
Carbon	12	Sulfur	32
Oxygen	16	etc.	

Thus, methane which has the formula CH_4 has a molecular weight of 16, and ethyl mercaptan (C_2H_5SH) has a molecular weight of 62.

The chemical analysis of many mixtures, such as petroleum oils, is usually not accurately known and hence other methods, such as that shown in Fig. 1, are used to determine the average mol weight. This figure relates molecular weight to the kind of oil, i.e. base of crude oil, cracking stock or kind of hydrocarbon; width or extent of boiling range; and average distillation temperature. In estimating the mol weight, move vertically from the average A.S.T.M. boiling point to the appropriate kind of material such as gasoline, kerosene, etc. Follow one of the sloping lines (or between them) to the base line of the main chart. Move vertically to the appropriate type of stock, such as recycle stock, mixed base, paraffin base, etc., and read the mol weight at the left.

Example.—A paraffin base gasoline has a 50 per cent A.S.T.M. temperature of 225° F. Following the lines indicated on the chart shows a mol weight of 106. Ten mols (1,060) would occupy 3,790 cu. ft. at 14.7 psia. and 60° F. and its volume at 330° F. (330 + 460 = 790° absolute) and 20 psia. (5.3 lb. gage pressure) would be:

$$20\,V = 10 \times 10.73 \times 790$$
$$V = 4{,}245 \text{ cu. ft.}$$

or if the 10 mols is handled in 1 hour:

$$\frac{4{,}245}{3{,}600} = 1.08 \text{ cu. ft./sec.}$$

Volumes are usually expressed as cubic feet per second so that velocity in feet per second in pipe lines, etc., can be computed. Fig. 2 can also be used for the above computation. It shows that the volume of 100 mols per hour of the gasoline when at 330° F. and at 20 psig. is 10.8 cu. ft. per second. This divided by 10 because 10 mols rather than 100 mols is being handled gives 1.08 cu. ft. per second.

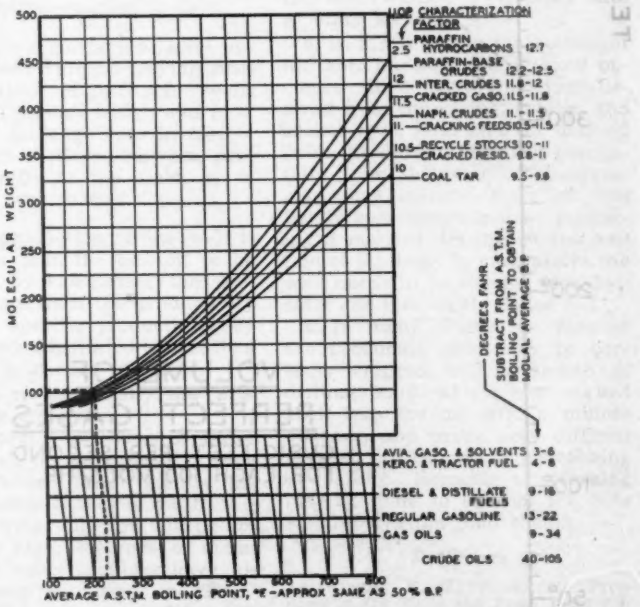

Fig. 1—Molecular weights of petroleum oils. (Courtesy, Watson & Nelson, Ind. Eng. Chem. 25, 880, 1933)

No. 47 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

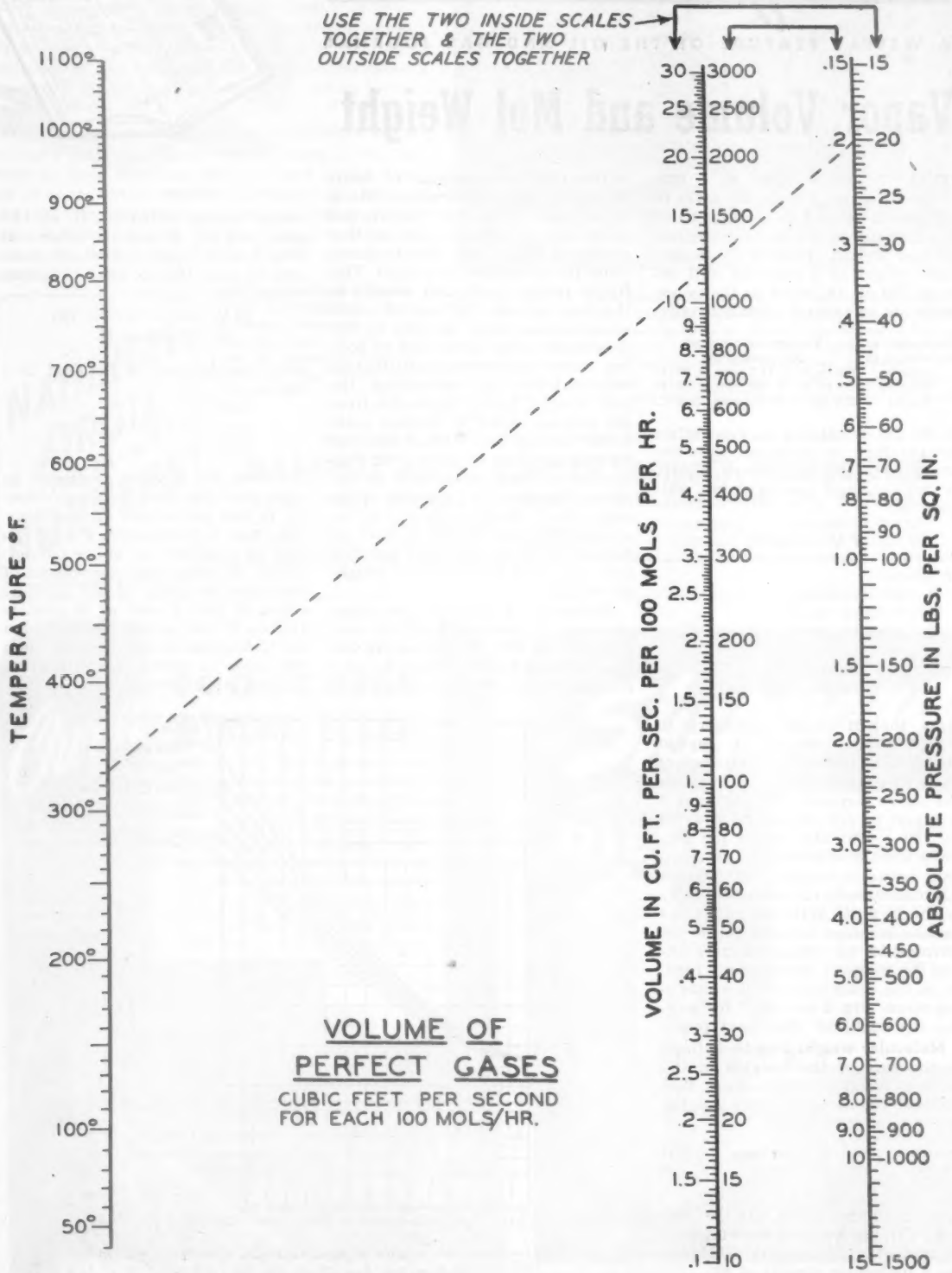

Fig. 2—Volume of gases that obey the gas laws

Engineering Fundamentals

No. 191

A FEATURE OF THE OIL AND GAS JOURNAL

Care and Treatment of Old Oil Wells To Maintain Maximum Productivity

Methods of determining how much oil a well should produce.— Productivity of an oil well depends for the most part upon the difference between the reservoir pressure and the bottom-hole pressure in the producing well, upon the viscosity of the oil, upon the relative permeability of the formation to the flow of oil, and upon the amount of water in the sand. In a reservoir having fairly uniform pay and fairly uniform quantities of water with the oil, relative productivity should be proportional to the differential pressure. Wells having about the same differential pressure should produce about the same amount of oil per day. Oil wells having the same pressure and producing less oil than the average usually need attention. It is now common practice in well-managed oil fields to measure reservoir pressures and bottom-hole pressures with a bottom-hole-pressure gage (see "Engineering Fundamentals," Nos. 92 and 93). With these data and the rate of production of the well, engineers calculate a factor known as the productivity index, which is a measure of the ability of the well to produce oil. Productivity index may be determined as follows:

$$\text{Productivity index} = \frac{\text{Production of barrels per day}}{(\text{Bottom-hole static pressure}) - (\text{Bottom-hole prod. pressure})}$$

For example, if a well is producing at the rate of 500 bbl. per day, if the recorded static pressure at the bottom of the hole is 1,000 psi., and if the producing pressure at the bottom of the hole is 200 lb., then the productivity index is:

$$\frac{500}{1{,}000 - 200} = 0.625 \text{ bbl. per lb. of differential pressure.}$$

Conversely, if one knows the productivity index of a well, then the production rate for any pressure differential can be estimated. Thus, suppose the productivity factor is 0.625 and the pressure differential is 1,000 lb. — 100 lb., or 900 lb. Then $0.625 \times 900 = 562.5$ bbl. per day, the amount of oil the well should produce if all factors are normal.

If the thickness of the sand varies greatly in different wells but reservoir pressures remain fairly constant, then it may be more satisfactory to apply another factor known as specific productivity as a means of comparing production efficiencies. The specific productivity is obtained simply by dividing the productivity factor by the thickness in feet of oil sand through which the oil is flowing, corrected to account for the diameter of the well and the draining area.

$$\text{Specific productivity} = \frac{\text{Productivity index}}{\text{Sand penetration} \times D}$$

Where D is a correction factor applied to take care of varying sizes of diameters of different wells and equal to $\log_e (r_1/r_2)$, and r_1 = radius of drainage area in feet = ½ average distance between producing wells in the field, r_2 = radius of well in feet.

If the production of the well is much less than the amount to be expected by calculating the production rate from the productivity index or specific productivity by the methods illustrated above, then the well is in need of repair.

Causes of abnormally low production in old wells:

1. Abnormal incursion of water in the well in the form of a cone or sheath can lower greatly the relative permeability to oil. In this case the water-oil ratio will be abnormally high. Methods of counteracting water troubles have already been discussed in "Engineering Fundamentals" Nos. 179, 180, and 181.

2. Precipitation of paraffin on the walls and in the pores in the oil sand around the edge of the well reduces production. In many places paraffin can be removed by solvents.

3. Precipitation of calcium carbonate from supersaturated calcium bicarbonate water, which in many places is produced with the oil, blocks off production. Calcium carbonate in the pores and on the surface of an oil sand can be removed and the well cleaned with hydrochloric acid.

4. Certain molds and anerobic bacteria produce gelatinous, paraffin-like deposits on the face of the sand. They have a fish-like odor and contain in the mesh of mold filaments all kinds of residual matter which finds its way into the hole, such as grains of silt, particles of iron rust, iron sulfide, calcareous chemical precipitates, and other matter. Such material needs to be drilled or scraped out and the hole washed with nitric acid or other solvents.

5. In a few places the bottom of the hole opposite the oil sand becomes filled with iron rust derived from the casing, tubing, and sucker rods, sand and silt derived from the oil and chemical precipitates from the water. The aggregate may become more or less firmly cemented together, producing a mass of detritus in the bottom of the hole. In such places the well needs to be cleaned mechanically and thoroughly bailed out.

6. In many places the face of the producing sand may be partially clogged with a sheath of drilling mud which has worked back into the oil sand a minute distance, and prove very difficult to wash out by ordinary swabbing or bailing. Reaming or scraping may be done to enlarge the hole and remove the mud sheath.

Reference

Hawthorn, D. G., Subsurface Pressures in Oil Wells and Their Field Application, A.I.M.E. Pet. Dev. and Tech., Vol. 103, pp. 148-169, 1933.

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas

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OIL AND GAS EQUIPMENT Digest

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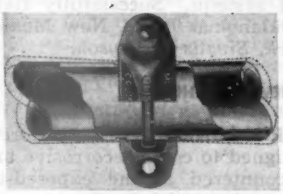
by Kenneth B. Barnes

(1) FLEXIBLE LOCK COUPLINGS have brought a great advance in pipe connections. Their use eliminates costly threaded pipe and fittings. Connecting up is faster—only two bolts to tighten. Dis-



assembly is much easier. Labor and material costs are substantially less. Pipe can be reused time and again. Inherent flexibility withstands shocks and vibrations—permits deflection up to 5°, allows for expansion and contraction of line where temperatures and pressures are subject to wide variation. Stand-up service proved in portable military pipe lines (subject to bombing), and in earthquake areas where sharp earth movements occur, applications are as many as for pipe itself. Exclusive design features make the Climax coupling 100 per cent satisfactory for use with steam, water, air, oil, or gas—in vacuum or pressure (up to 1,000 lb. w. p.) service. *Hanlon-Waters Co.*

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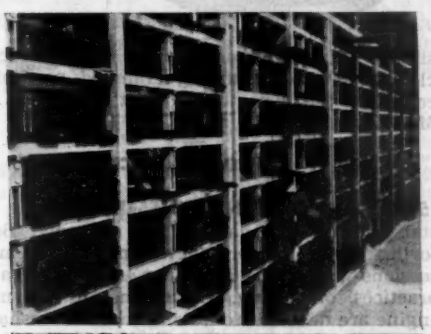
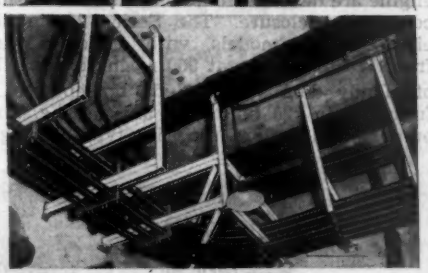
(2) NEW LUBRICANT ADDITIVE is announced under name of Plexol 201. Used in preparation of lubricating oils and special lubricants, its properties are: Viscosity ranges from 3.3 centistokes at 210° F. to 12.7 at 100° F. to 1,450 centistokes at 40° F.; viscosity index 150; flash, above 400° F.; carbon residue 0.04; freezing point, below —50° F.; pour point, below —70° F.; specific gravity, 60/60° F., 0.917. *Rohm & Haas.*

(3) BUILD "ON-THE-JOB" WITH UNISTRUT. Framing, racks, supports, etc., either temporary or permanent, can now be quickly put up for rigs, production equipment, in refining and gasoline-plant installations. Unistruts save time, always make perfect fits, can be reused again and again. Consist of slotted hollow-square steel sections and standard spring-held nut attachments. No drilling, riveting, or welding. Cut to any desired length with a hack saw. Nut attachment slides in the hollow square to any point. Unistrut nut





has serrated teeth which bite and hold firmly. Because of hollow-square design, has necessary properties for use either as compression or tension members. Eliminates delays caused by waiting for shapes and figuring "fits." *Unistrut Products Co.*

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(4) NEW INSPECTION LAMP brings the inside "outside." Heretofore, inspection of inside surfaces of many jobs has been slow and tedious. Viewing of objects with deep openings is made easy,

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as the inside of the equipment being inspected is brought out clearly in the adjustable mirror. A strong light is thrown inside the cavity, where the light is needed—not in the eyes. Operator

simply adjusts mirror to point where he can see clearly without assuming cramped position, and completes the inspection without eye strain. *McGill Manufacturing Co., Inc.*

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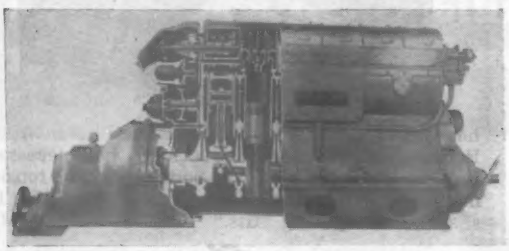
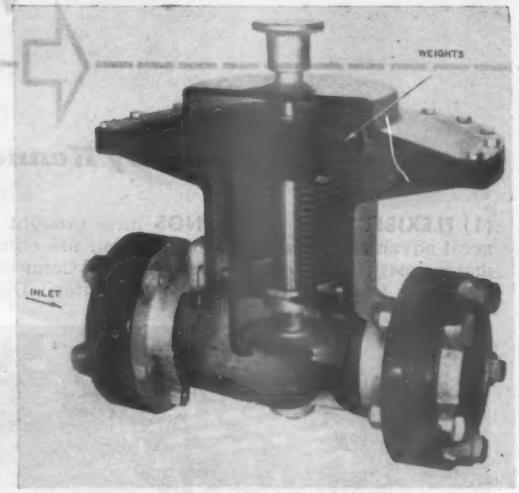
(5) NEW "20" HENDY DIESELS bring new standards of dependability and economy. Brought forth from the owner's viewpoint entirely, no concessions were made in design, use of old patterns, practices, or tooling. Clean lines of the modern engine are derived from its overhead camshaft and complete enclosure. The Series 20, in six and eight-cylinder models, with a power range of from 190 to 250 hp. at 900 r.p.m., extend the line of Hendy diesels to include horsepower ratings from 190 to 780 hp. Have air starting, unit fuel pumps and injectors, precision-type bearings, full-



pressure lubrication, underhung crankshaft, removable cylinder liners, and auxiliary drives arranged at either end. Entirely self-contained, with all main accessories engine mounted; drilled connecting rods. All bearings may be removed individually through large side inspection doors without disturbing the crankshaft or any accessories. Cooling-design feature assures freedom from rust, and chemical deposits. The raw water enters the raw-water pump, passes through a heat exchanger and is discharged. The fresh water is circulated by pump first through the oil cooler, then into the engine-water header, and to each cylinder space through a metering hole which gives a tangential swirl around each cylinder liner. *Joshua Hendy Iron Works*

(6) NEW OIL SEAL VALVE for pipe lines has automatic action. Requires no manual setting with each run or manual venting of air. Improves pipeline-system efficiency by decreasing running time, eliminating air from system, lowering gathering-



station pumping costs and field-labor expense. Does away with gravity and volumetric losses caused by air being drawn into line and possibility of air-locked systems. Successfully field-tested in Illinois, Oklahoma, Texas, New Mexico, and Michigan. *Black, Sivalls & Bryson.*

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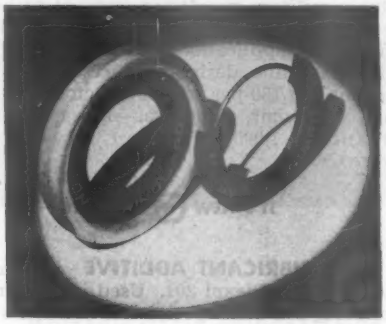
(7) NEW HILTON RINGUARD, a steel-reinforced flexible liner, is designed to combat corrosive and abrasive action encountered at the exposed-to-pressure section of metal ring joints. Serves as an auxiliary pressure seal. Employs a V-groove-type oil-and-gas-resisting material with self-adjusting.



spring-steel wire core to keep the liner in required operating position against ring joint when bolt action is applied to the flange. V groove provides well-known lip action essential for pressure-sealing purposes. Steel core prevents bulges or spreads. Hermetically seals off from flow stream. Available for all sizes of A.P.I. rings. *L. D. Hilton Co.*

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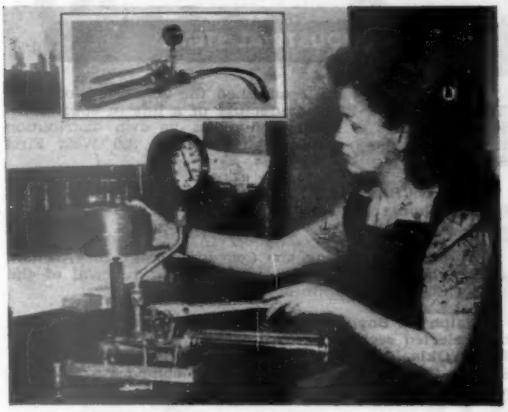
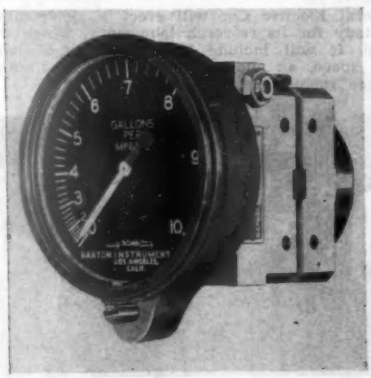
(8) LAB-FIELD GAGE TESTER combines for first time in a single unit a pressure gage tester that can be used with equal facility for bench testing and for portable testing in the field. On bench testing, the unit can be used with test gages or



with a dead weight attachment. A unique, but simple, doubly sealed check valve, completely eliminates leakage and loss of pressure even with grit in the system, whether using oil or water and for pressures up to 10,000 psi. Principal uses of the testing unit include testing and repairing of pressure gages and instruments, setting of relief or other pressure-actuated valves, general hydrostatic testing. *Mansfield & Green.*

IT'S NEW CHECK IT

(9) RATE-OF-FLOW INDICATOR combines many unique features yet is extremely small and compact—only 3¼ by 4 in. Furnished for pressures to 1,000 psi., differential is measured by a rupture-proof twin or opposed bellows unit which provides two chambers. One is high pressure, the other low, and in effect are separated by a frictionless piston.



There is no mercury used; need for accurate leveling eliminated, no "wet leg" correction when metering liquids. A few of the many applications are: to show filter and back-wash rates, cooling water or oil flow, steam flow to equipment, oil and gas flows in refineries and absorption plants *Barton Instrument Co.*

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TRADE LITERATURE

(10) VAPOR CONSERVATION EQUIPMENT. A full line of safety gas-tank manholes for tanks, gas-tight swing-pipe controls; hand gage and self-closing foot gage hatches; adjustable leak-proof level indicator guides, antifreeze valves;

OIL AND GAS EQUIPMENT

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breeze valves; drawoff valves, etc. *American Premaberg Co.*

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(11) GAS PROCESS EQUIPMENT: Bulletin available including descriptions on automatic steam accumulators, naphthalene scrubbers and washer coolers, RS de-emulsifiers, heat exchanges, three-way valves for gas handling, and welded piping. *Semet-Solvay Engineering Corp.*

IT'S NEW CHECK IT

(12) P-M PORTABLE RIGGERS' FORMING VISE. New bulletin illustrating use and giving specifications. An item of equipment widely used in the handling of cable and wire rope in sizes from ⅜ in. to 1½ in. diameter, without the use of adapters. This vise, 17½ in. wide by 19½ in. in length, with a front jaw spread of 10 in. maximum, greatly simplifies the problem of bending into shape and handling all sizes of wire rope used in the oil fields. *Patrick-McDermott Co.*

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(13) EXPANDED METAL GRATING. Attractive six-page fold-out bulletin is illustrated to show four types of expanded metal used principally for floors and walks. Contains list of diamond sizes and lists advantages of each type for different uses. *Wheeling Corrugating Co.*

IT'S NEW CHECK IT

(14) OIL CUSHION BRONZE BEARINGS. Bearings made of oil-cushion bronze described in four-page folder showing what can be achieved with Oilite oil-cushion bronze. Contains high-grade crankcase lubricating oil to the extent of one-third of its volume and its peculiar capillary structure provides for a permanent hydraulic oil cushion. Gives sizes and prices. *Chrysler Corp.*

IT'S NEW CHECK IT

(15) AUTOMATIC ENGINE CONTROLS. Booklet discusses their development and applications. Tells of the various types and gives service and maintenance tips. *Synchro-Start Products.*

IT'S NEW CHECK IT

(16) GEIGER COUNTER SPECTROMETER. For industrial research. New instrument measures X-ray intensities and diffraction angles of powdered chemical and metallurgical samples directly and speedily, by using a Geiger counter tube to actuate a scale-of-64 flip-flop circuit that feeds an impulse register. Illustrated and described in eight-page bulletin. *North American Philips Co., Inc.*

IT'S NEW CHECK IT

(17) THREAD-MILLING MACHINE. Eight-page, well-illustrated booklet describes the Super-Duty "O W" thread miller for threading tool bits, tool joints, pipe, or casing. Ideal for heavy threading.

Capacity, steel, two threads per inch with 8½-in. face. Designed for internal or external, straight or taper, right or left-hand threads. *The Lees-Bradner Co.*

IT'S NEW ✓ CHECK IT

(18) ELECTROLYTIC CORROSION-RETARDING UNITS. Booklet describes in detail a practical and effective method of protection against electrolytic corrosion for pumping oil wells, oil-field wash tanks, and other tubular installations. Units for large nontubular installations such as ships and storage tanks are also listed. *Baroid Sales Division, National Lead Co.*

IT'S NEW ✓ CHECK IT

(19) OCCUPATIONAL DISEASES given on large and easy-to-read wall chart designed for plant hospitals, dispensaries, safety directors. Diseases encountered in industry are listed for quick reference as well as the approved treatment. Size 34 by 22½ in. *The Pioneer Rubber Co.*

IT'S NEW ✓ CHECK IT

(20) SAFETY LINER HANGERS and companion equipment featured in a comprehensive booklet. Describes and illustrates complete line, with details of construction, different types, and operating instructions. Features a description of the economies resulting from the practice of using a liner hanger in well-completion operations. *Burns Tool Co.*

IT'S NEW ✓ CHECK IT

(21) WELDER'S GUIDE. A 31-page booklet compiled under the direction of a member of the Society of Automotive Engineers which is designed to give all welders a comprehensive guide to successful hard facing. Technique is discussed in detail with drawings to illustrate points under discussion. *Mir-Col Alloy Co.*

IT'S NEW ✓ CHECK IT

(22) AUTOMATIC GAS-HEATING CONTROLS. A service and instruction manual which gives in detail the general description, method of operation, installation instructions, and service troubles and remedies on automatic gas heating controls. *General Controls Co.*

IT'S NEW ✓ CHECK IT

(23) SYNTHETIC OPTICAL CRYSTALS. A well-illustrated 16-page booklet designed to acquaint readers with the method used to grow optical crystals. Due to their quality and size these optical crystals stimulated design and construction of infrared equipment previously considered impossible. Used in research and control instruments in production of synthetic rubber and aviation motor fuel. *The Harshaw Chemical Co.*

INDUSTRIAL ITEMS

C. B. Johnson has established the Johnson Block Co., Tulsa, Okla., for the manufacture of a line of special oil-field blocks. The company handles its own distribution from offices and warehouse located at 320 West First Street.

The D+B Division of Emsco Derrick & Equipment Co. announces the opening of a new Continental D+B store in Odessa, Tex.

The Farrel-Birmingham Co., Inc., plants at Ansonia and Derby, Conn., has received its fifth renewal of the Navy "E" award, within 3 years.

Ralph W. Boyd, formerly with Shell Oil Co., Inc., has been elected secretary-treasurer of Walter O'Bannon Co., Tulsa, Okla. **Leslie J. Bates**, who has been with Public Service Co., will have charge of the company's research, mechanical, and management engineering activities.

New board members of the Girdler Corp., Louisville, Ky., are **Tom Mercer Girdler**, chairman of Republic Steel Corp.; **R. I. Ingalls, Jr.**, president of Ingalls Iron Works, and **Charles J. Haines**, president of National Cylinder Gas Co., which with Girdler Corp. jointly owns Tube-Turns, Inc. Reelected as members of the board were **George O. Boomer**, president of Girdler Corp.; **Rudy Fritsch**, president of Tube-Turns, Inc.; **Earl R. Muir**, president of Louisville Trust Co., and **Erskine H. Courtenay**, sales manager of Mengel Co.'s furniture division.

General American Transportation Corp. has acquired Eclipse Moulded Products Co. of Milwaukee, Wis., manufacturers and distributors of plastic products. Operations of the Eclipse company will continue as before under the same management.

Houston Oil Field Material Co., Inc., Houston, Tex., has received its second star in its "E" flag for the production of Army materiel.

Robert D. McManigal has been elected a vice president of Westinghouse Electric International Co. McManigal, whose office is at New York, has been manager of the International company's associated companies department since 1940.

General Electric Co. will erect a new building at Schenectady for its research laboratory, which will cost $8,000,000. It will include 200,000 sq. ft. of laboratory working space, an auditorium seating 300, dining room, conference rooms, etc.

Three of Dresser Industries' 13 companies were represented in this recent meeting at Huntington Park, Calif., of J. B. O'Connor, executive vice president of Dresser, with top executives of Pacific Pumps, Inc., International Derrick & Equipment Co., and Kobe, Inc. Left to right: L. R. Wells, president, International Derrick & Equipment Co. of Calif. C. J. Coberly, president of Kobe, Inc., O'Connor, and E. J. Weis, vice president of Pacific Pumps, Inc.

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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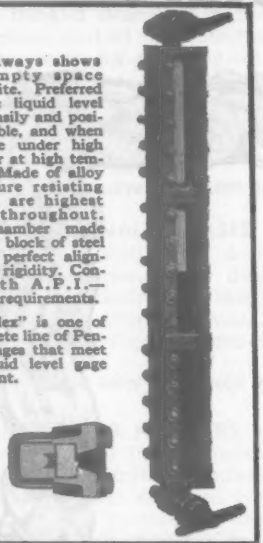

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REFINING

Patents Granted for Two New Refining Processes

WASHINGTON. — United States Patent Office has granted to Miller W. Conn, Bartlesville, Okla., a patent on a process of removing sulfur compounds from oil, which he assigned to Phillips Petroleum Co. Conn uses a catalytic method and takes the sulfur out of hydrogen sulfide.

Donald L. Fuller and Bernard S. Greensfelder, of Oakland, Calif., received a patent on a method of producing synthetic benzene which they assigned to Shell Development Co. of San Francisco. They treat a hydrocarbon fraction consisting essentially of methyl cyclopentane under hydroforming conditions with a molybdenum oxide catalyst and produce benzene as a principal conversion product.

PAW Bars Use of Residual Fuel as Paving Material

WASHINGTON. — With inventories of residual fuel at the lowest level since the beginning of the war, it has become necessary to prohibit its use as paving material anywhere in the United States, Deputy Petroleum Administrator Ralph K. Davies has announced. Action was taken by amending Petroleum Administration for War Directive 72, which banned the use of road oil only in the West Coast states. The amendment extends the restriction to all other states and the District of Columbia.

An immediate result is expected to be that refiners will switch from making this grade of road oil to production of heavy fuel oil.

Civilians to Get 1,404,000 Bbl. of Gasoline Daily

WASHINGTON. — Civilians will get 1,404,000 bbl. of gasoline daily during the third quarter of 1945, Deputy Petroleum Administrator Ralph K. Davies announces. The allowance includes a regular allocation of 1,264,000 bbl. daily, which meets rationed civilian requirements in full for the 3 months—July, August and September—and provides an additional allocation of 140,000 bbl.

The regular allocation is 14,000 bbl. a day greater than that for the same quarter in 1944. The additional daily allowance of 140,000 bbl. will become available on June 22 to meet the announced increases in A-card values and B-card ceilings.

"The regular and extra allocations have been made," Davies said, "with the understanding that the petroleum industry will be able to continue its all-out production and that every barrel not required for military and other essential war needs should be made available to the civilian motorists as rapidly as possible."

Indiana Standard Praised For War Salvage Efforts

NEW YORK. — The shortage of heavy melting iron and steel scrap is measurably relieved by efforts like those of Standard Oil Co. (Indiana), according to W. Thomas Hoyt, director of the conservation and salvage division of War Production Board. Hoyt reported that Indiana Standard had shipped from its Whiting and Wood River refineries almost 2,700 tons of heavy melting iron and steel scrap to steel mills for reuse in the war production program, in the 6-month period ending March 31. H. F. Glair, general manager of the company's manufacturing department reported that 1,100 tons of the war material was being shipped during May from the Whiting refinery alone.

Russia Planning to Supply All Its Own Motor Fuel

WASHINGTON. — Information reaching the oil industry of this country indicates that Russia is planning eventually to supply all its own motor fuel from raw material locally available. The raw-material sources include not only petroleum, of which Russia is believed to have vast reserves as well as large current production, but also coal, shale, lignite, wood or other vegetable matter.

The information is being released by research institutions in the U.S.S.R. Specifically these reports come from J. C. Tolpin, editor of the U.O.P. Survey of Foreign Petroleum literature, who is translating the releases.

Russia's prime difficulty in this

field appears to be transportation. The transportation limitations are handicapping utilization of the country's great petroleum resources, making it difficult to distribute motor fuel and other products long distances. Therefore, it is considered desirable that motor fuel be produced locally.

The fuel is needed primarily for trucks and tractors as there are few passenger automobiles in rural districts.

Research on production of substitute motor fuels from shale and peat began more than a dozen years ago. An industry resulted which, as far back as 1937, produced 1,400,000 bbl. of petroleum substitutes. This production has been increasing yearly.

A new industry also is created to manufacture liquid petroleum substitutes from wood. It is estimated 100,000 or more trucks are operating on gas made by burning raw wood chips in an attached gas generator.

Charcoal, lignite, natural gas, and many other substances are also being investigated as practical sources of motor fuel.

Extensive research on substitute motor fuels is being carried out at the Institute of Mineral Fuels of the Academy of Sciences and other institutions in the U.S.S.R.

Oil Sands, Ltd., Acquires Gold Standard Oils Plant

EDMONTON, Alta. — Oil Sands, Ltd., which is expanding operations of the former International Bitumen tar sand plant at Bitumont, on the Athabaska River, has acquired control of the properties of Gold Standard Oils, including the company's refinery at Wainwright, Alta. The plant, specially designed to process heavy crudes, will furnish an outlet for production from the extraction plant at Bitumont.

Bureau Issues Report on Oklahoma Crude Analysis

WASHINGTON. — The third in a series of detailed reports on analyses of Oklahoma crude oils has been issued by Bureau of Mines to aid refiners, manufacturers and marketers of oil products in the conservation and efficient utilization of petroleum. Prepared in cooperation with the state of Oklahoma and American Association of Petroleum Geologists, the report contains Bureau of Mines Hempel analyses of 248 additional crude oil samples from 153 Oklahoma fields, offering detailed information on samples from many areas and formations not included in previously published surveys. It includes individual and collective information on the new samples, showing origin and some characteristics.

University Butadiene Plant Affording Important Help

MADISON. — A small-scale butadiene plant at the University of Wisconsin here is affording information to engineers which will improve the design and operation of synthetic-rubber plants throughout the country. The butadiene research, which is giving important help to American war production, is conducted by Prof. Kenneth M. Watson, of the chemical engineering department.

The most vital problem now facing American rubber producers is conservation of butane, the raw material from which both butadiene and an important constituent of aviation gasoline are obtained. Since both of these materials are scheduled for increased production in 1946, it is of paramount importance that the available butane be used efficiently.

Any butane saved by the industry in the manufacture of synthetic rubber will be utilized for aviation gasoline, Professor Watson said. The research conducted at the university, at present the only institution undertaking the work, is sponsored by Rubber Reserve Co., a government agency under Reconstruction Finance Corp.

The chemical engineering department recently completed an 18-month project on the production of chemicals used in TNT manufacture. This project, conducted under Office of Production Research and Development, helped American manufacturers obtain the necessary materials for TNT and rubber from petroleum, rather than from coal tar, a relatively scarce substance.

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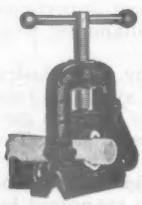

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Natural Gas

Manufacturers Seek to Increase Bessemer Sales

PITTSBURGH. — Federal Power Commission held a hearing June 14 on the application of The Manufacturers Light & Heat Co. for authority (1) to operate an existing connection between its pipe line and that of Bessemer Natural Gas Co. where they cross in North Beaver Township, Lawrence County, and (2) to sell an average of 1,000,000 cu. ft. of natural gas a month to the Bessemer company.

On August 4, 1944, Manufacturers was granted authority to deliver 60,000 cu. ft. of natural gas daily to Bessemer for a period of 3 months. Manufacturers has received two extensions of this temporary authority, and at present has permission to continue the delivery of natural gas to Bessemer until November 4.

FPC Approves Export of More Gas From Texas

WASHINGTON.—Federal Power Commission has granted to Tennessee Gas & Transmission Co. authority to pipe 60,000,000 cu. ft. more of natural gas daily into the Appalachian area as a war emergency measure.

Specifically, it gave the Houston company permission to operate under lease from Defense Plant Corp. four new compressor stations totaling 33,600 hp. to be built by DPC, and to construct new facilities at five existing stations.

Jester's Position on Gas Exportation Unchanged

AUSTIN.—"Until and unless it is definitely shown to me that Texas reserves of natural gas are ample for present needs and for the state's industrial demands of the future, I am against all applications to take gas out of this state," declared Beauford H. Jester, of the State Railroad Commission, commenting on petitions being circulated in the Rio Grande Valley and on endorsements by chambers of commerce of the Reynosa Pipe Line Co.'s plan to move gas out of Texas.

"My attention has been called to a systematic campaign to change my views about piping gas out of Texas," said Jester, "but it might as well be known now as later that I shall adhere to my present policy of opposing all applications to export gas until an investigation has fully demonstrated that our reserves will warrant it.

"Natural gas is a marvelous natural resource and I am against sending it out of this state to benefit some other state unless we know absolutely that our supply is so huge that it cannot be exhausted before our industries develop and want it."

Reynosa had applied to export 60,000,000 cu. ft. of Texas gas daily to Monterrey, Mexico, but was turned down by Federal Power Commission.

Coincidentally, and possibly having had its effect in the case, was the fact that a gas well was brought in south of the Rio Grande near the Mexican border. This substantiated the contention that Mexico has gas reserves.

Rating of Poor Gas Wells As Marginal Suggested

AUSTIN. — Classification of low-pressure gas wells as marginal, with allocation of such allowables as they are capable of making, is suggested by Arkansas Louisiana Gas Co. in a communication to Railroad Commission of Texas.

"Although we have installed compressors and eliminated the flaring of oil well gas in the Jefferson area of the Rodessa field, as well as having installed compressors to allow gas wells having low operating pressures to feed into the system," says the company, "we are still finding that a number of wells cannot produce their scheduled allowables. This difficulty, of course, could be eliminated in the same manner as that used for oil well proration, that is, to classify them as marginal wells and only allocate them such allowables as they are capable of making."

The company asks that separate allowables be set up for Hill sand wells in Cass County and wells producing from the same sand in Marion County, as there is no structural connection between the two areas. It asks also that separate schedules be issued for two different areas producing from the Gloyd sand in the Rodessa field, to avoid drainage from one area into the other. A hearing is to be held June 27.

Natural Gasoline

Lines Being Laid for New McCarthy Gasoline Plant

HOUSTON.—Gas lines are being laid from the new Glenn H. McCarthy gasoline plant near Winnie, Chambers County, to serve Port Arthur; Neches Butane Products Co., Beaumont area, and the E. I. du Pont de Nemours & Co.'s nylon plant at Orange, Tex. A spur track is being laid from Santa Fe lines to the plant site, where a loading rack will be erected. Facilities are also provided for tank loading as there is considerable local demand for butane and propane mixtures and tractor fuels.

Construction of the plant was started January 2, and unless unforeseen delays are encountered in the delivery of materials, it will be in operation by September 1.

The low-pressure part of the plant, which will handle the casinghead gas up to 30,000,000 cu. ft. daily, will operate at 450 lb. pressure, using the conventional absorption system. Ten 800-hp. compressors are being installed. The low-pressure part of the plant can be increased to 45,000,000 cu. ft. by addition of more compressors.

The high-pressure gas from condensate wells in the fields will be processed at the plant, operating through absorbers operating at 850 lb. This gas carries considerable condensate which also will be processed. The capacity for handling this high-pressure gas will be up to 55,000,000 cu. ft. daily.

Northern Natural to Build Gasoline Plant in Kansas

TOPEKA.—The Kansas Corporation Commission has granted to Northern Natural Gas Co. authorization to build a natural-gas dehydration and natural-gasoline recovery plant on the company's compressor-station site in Seward County. Northern Natural, whose principal office is in Omaha, Neb., estimates that the natural-gasoline and liquid-hydrocarbon recovery plant will cost $898,804 and the dehydration plant $211,698. All the facilities are expected to be in operation by January 15, 1946. The gas to be processed will come from the Hugoton field.

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PIPE LINES

Stanolind's Wyoming Line Gets WPB Approval

WASHINGTON.—War Production Board has approved the application of Stanolind Pipe Line Co. for authority to construct a 63-mile, 8-in. crude-oil line from Steamboat station to connection with an existing 12-in. line from Elk Basin to Casper at a point near Lysite, all in Fremont County, Wyoming. Pump station, tankage and other facilities will be erected at Steamboat. This line, which will have a daily capacity of 12,600 bbl., is planned to replace present tank car and truck movements.

The project provides for 21 miles of 6-in. gathering lines to give outlets from Circle Ridge, Maverick Springs, Steamboat Butte, Pilot Butte and Winkleman dome pools.

Also provided is construction of a 14-mile, 6-in. line from junction with the main line to Riverton, Wyo. This will be used for delivering crude to Husky Refining Co.

Work is expected to start in September. New pipe will be used. Cost of the entire project is estimated at $1,255,000.

Texas-Empire Announces Expansion Program

Texas-Empire Pipe Line Co. has announced an expansion program on its system from the Southwest to the Chicago refining area to cost $3,500,000.

The program includes completion of looping along 164 miles of the trunk system from Sheldon, Mo., to Heyworth, Ill. Completion of this job will provide a double 12-in. line all the way from Sheldon to the

PIPE-LINE PERSONALITIES

WILLIAM E. HONEY, district manager, Williams Brothers Corp., at Atlanta, Ga., was born August 8, 1910, at Pine Bluff, Ark., where his father was a railroad engineer. While going to high school, he had a job with a building supply firm. Shortly after graduation in 1928, he was employed by Williams Brothers Corp., then contracting the laying of the Monroe, La.-St. Louis natural gas line of Mississippi River Fuel Corp. His first job was in a gang on the line bolting couplings. Later he was in the Pine Bluff office. The next year he was a timekeeper for this contractor in Alabama during construction of the Southern Natural Gas Co. line.

In November, 1939, he moved to Atlanta, where he has been located for nearly 6 years. While the Southeastern Pipe Line Co. line was being built, he was office manager. Later when the Plantation Pipe Line Co. system was built, Honey became manager of the southeastern district for Williams Brothers, and his responsibilities were extended to include those of estimating and bidding on contracts. Subsequently he has expanded activities so that in addition to the laying of pipe lines he has been engaged in construction of dock lines, airport piping, and terminals and in the operation of the company's shop at Chamblee, near Atlanta, where precision piping fabrication, making of pipe-line equipment, and some munitions work has been handled during the past year. The shop business is an enterprise developed on Honey's initiative to take advantage of opportunities in the area.

Honey is married and has a 2½-year-old son. He has established his residence at Atlanta.

Chicago area, and increase capacity from 90,000 to 110,000 bbl.

To increase the capacity of the line between Cushing, Okla., and Sheldon, stations at Sand Springs and Scammons, Kans., now inoperative, will be put into operation. Capacity of the Alluwe station will be increased. These improvements will increase the line capacity by 17,000 bbl. daily.

The Texas - Empire system, 730 miles long, is owned equally by Empire Gas & Fuel and The Texas Co.

New Pipe Lines to Supply Gas for Indiana Towns

WASHINGTON. — Federal Power Commission has issued certificates of public convenience and necessity authorizing: (1) Panhandle Eastern Pipe Line Co. to construct and operate a short pipe line beginning at a point on Panhandle Eastern's "Greenfield Lateral" in Hancock County, Indiana, and extending to Fortville, Ind., and (2) Eastern Indiana Gas Co. to construct and operate a line extending from Panhandle's line at Fortville to Ingalls, Ind.

Fortville, Ingalls, and McCordsville were formerly supplied with natural gas from local wells, which have become depleted. Ingalls is without a gas supply and the two other towns have inadequate supplies.

Public Service Commission of Indiana and the public counsellor of Indiana participated in hearings on this matter held in Indianapolis, in December 1944, and in Washington in February 1945. The Indiana commission took the position that a new line to these communities is required to provide adequate service.

The FPC order specifies that the facilities to be constructed by Panhandle shall not be used to transport and sell gas to new customers except upon specific authorization of the commission. The order also provides that construction of the facilities shall be completed on or before September 30, 1945.

Building of Iraq Line to Be Started Next Year

Preliminary engineering has begun for a new 16-in. pipe line reaching 620 miles from Kirkuk in Iraq to Haifa, and laying of the pipe will start next year, according to Iraq Petroleum Co. Haifa is on the Mediterranean seacoast.

The company said cost of the project is estimated at $50,000,000 and that 120,000 tons of 16-in. pipe has been ordered from England. Operations are expected to begin early in 1948 with an initial annual capacity of 23,000,000 bbl. of crude oil.

Terminus for the line will be Consolidated Refineries, Ltd., owned by Anglo-Iranian Oil Co. and Shell interests, and the carrier will parallel a smaller line already in existence.

The project of Iraq Petroleum, a jointly American, British, French, Dutch-owned concern, is in addition to the trans - Arabian pipe line planned by The Texas Co. and Standard Oil Co. of California which hold a Saudi-Arabian concession, through the jointly-owned Arabian-American Oil Co.

The plans for a Kirkuk-Haifa pipe line indicate it will be a major world petroleum transportation project, since it will make possible large-scale, low-cost movement of Middle East oil toward access to world markets by sea.

Answering queries whether this line might influence decision on building the Arabian-American line across Arabia, Arabian-American officials said the new Iraq line would have no effect on its plans for a Saudi-Arabian line.

However, it is known that the Saudi-Arabian line, if and when built, will not be a United States Government project, as was originally proposed by Petroleum Reserves Corp., a subsidiary of Reconstruction Finance Corp.

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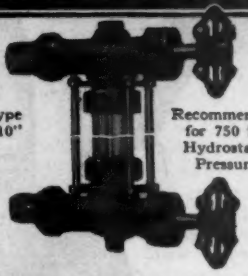

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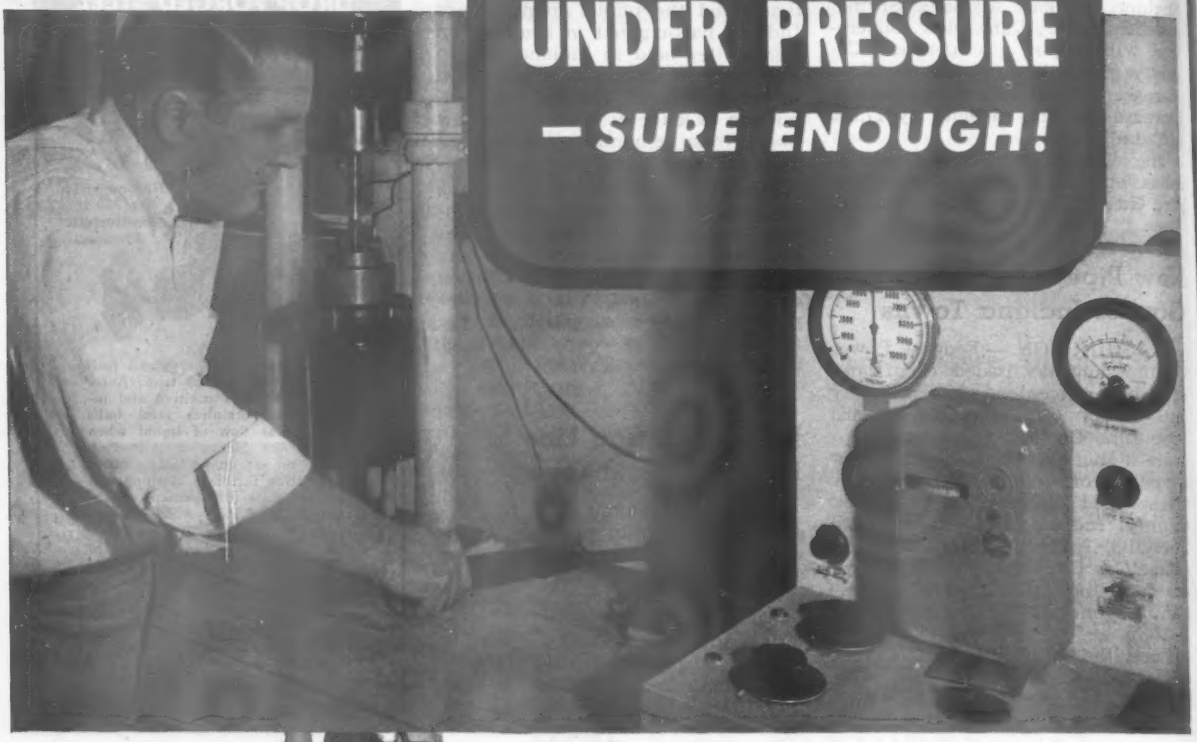

PERFORMANCE of Lone Star Cements is PRE-TESTED in our Oil-Well Cement Laboratory before the cement leaves the shipping platform. Tests on the Stanolind Pressure Consistometer, for instance, give accurate results under high pressures and temperatures encountered in the field.

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*Reg. U. S. Pat. Off.

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Exploration and Drilling

Week's Highlights

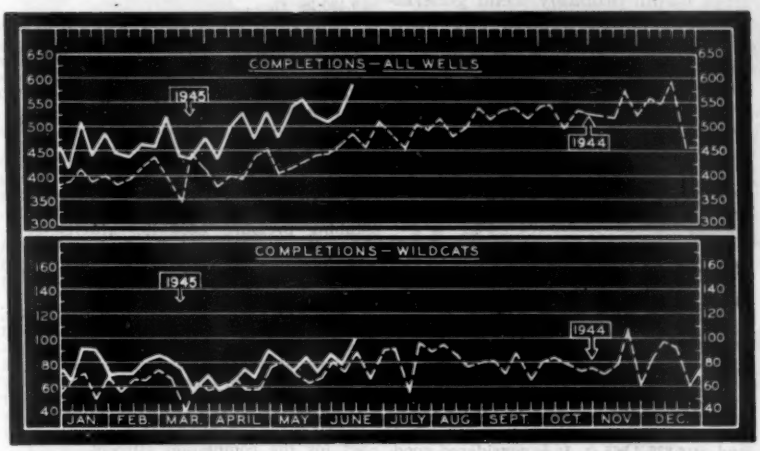
DISCOVERY of Smackover limestone with porosity and a show of oil in a deep test in the Tinsley field in Mississippi is a very important geological development. It upsets the previously held opinions about Smackover possibilities as an oil-producing formation, not only in northern Mississippi, but probably westward from Tinsley across the eastern part of southern Arkansas and northern Louisiana.

Union Producing Co. 21 Jennie Stevens, center E/2 NW NW 12-10n-3w, in the northwest part of the Tinsley field, had 19 ft. of saturated Smackover limestone at 10,836-56 ft., and recovered a core which bled light green oil at 10,656-66 ft.

Prior to this discovery, on the basis of the only available evidence, the results from some wells drilled in Alabama on the Hatchetigbee anticline, it was thought that in all probability as the Jurassic sea deposits came east from southern Arkansas and northern Louisiana, across Mississippi, there was a complete change of facies in the Smackover to a shaly formation, with prospects of porosity very slim.

Therefore, regardless of the immediate outcome of the Tinsley test, there is a complete change of opinion about Smackover possibilities in Mississippi. Evidently the shaling out took place much farther east than previously thought. The most obvious next prospect is a Smackover test sooner or later in the Pickens field.

Moreover this discovery will probably encourage some plays west of Tinsley. There has been a certain amount of discouragement about



Solid line charts current weekly completions, service wells in Eastern area included

WEEKLY WELL COMPLETION RECORD . . . WEEK ENDED JUNE 16, 1945

	Total of all wells					Cum. to date		Wildcat completions and discoveries									
													Cumulative total, 1945				
	Comp.	Oil	Gas	Dry	Footage	1945	1944	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	26	13	0	*13	34,600	587	688	0	0	0	0	0	0	0	0	0	0
Pennsylvania	80	42	5	†33	145,115	1,717	1,562	0	0	0	0	0	0	0	0	0	0
West Virginia	27	5	20	2	61,732	362	366	0	0	0	0	0	0	0	0	0	0
Ohio	33	11	11	11	80,480	387	420	0	0	1	3	4	0	0	8	31	39
Indiana	0	0	0	0	0	75	95	0	0	0	0	0	2	0	0	10	12
Kentucky	16	9	1	6	24,024	192	296	2	0	0	0	2	13	0	2	18	33
Illinois	34	17	1	16	92,487	728	750	1	0	0	10	11	20	0	0	120	140
Michigan	17	4	1	12	38,702	342	271	0	0	0	9	9	5	0	2	113	120
Kansas	39	19	0	20	125,485	724	773	0	0	0	11	11	18	0	9	153	180
Neb., Mo., Iowa	0	0	0	0	0	12	15	0	0	0	0	0	0	0	0	9	9
Oklahoma	68	41	1	‡26	283,943	1,097	733	1	0	0	15	16	44	1	7	159	211
Texas	147	79	15	53	636,022	3,261	2,392	3	0	1	24	28	109	6	23	597	735
North Central	61	25	2	§34	163,067	950	640	0	0	0	11	11	40	0	4	213	257
West	28	25	0	3	151,388	864	693	3	0	0	2	5	29	0	0	131	160
Panhandle	10	1	8	1	31,583	243	86	0	0	0	0	0	0	0	1	4	5
Eastern	16	9	2	5	97,993	149	150	0	0	0	3	3	5	3	0	41	49
Gulf Coast	20	13	1	6	128,729	753	472	0	0	0	4	4	26	2	14	127	169
Southwest	12	6	2	4	63,262	302	351	0	0	1	4	5	9	1	4	81	95
Louisiana	20	9	2	9	127,678	451	334	0	0	0	4	4	15	2	4	56	77
Northern	11	3	2	6	40,896	152	124	0	0	0	2	2	2	1	4	31	38
Southern	9	6	0	3	86,782	299	210	0	0	0	2	2	13	1	0	25	39
Arkansas	2	1	0	1	10,934	77	94	0	0	0	1	1	0	0	0	23	23
Mississippi	8	2	0	6	69,395	162	52	0	0	0	2	2	3	0	0	51	54
Southeastern States	1	1	0	0	3,624	23	15	0	0	0	0	0	0	0	1	15	16
Montana	6	4	1	1	15,813	144	132	0	0	0	1	1	7	0	0	10	17
Wyoming	2	2	0	0	9,605	86	73	0	0	0	0	0	8	0	0	17	25
Colorado-Utah	1	1	0	0	6,480	15	14	0	0	0	0	0	1	0	0	3	4
New Mexico	10	10	0	0	38,938	214	184	1	0	0	0	1	7	0	2	29	38
California	49	32	3	14	192,761	1,062	884	0	0	0	10	10	1	0	2	96	99
Total United States	586	302	61	223	1,997,818	11,718	10,143	8	0	2	90	100	253	9	60	1,510	1,832
Total previous week	525	299	41	185	1,907,003	11,132	9,634	7	1	3	67	78	245	9	58	1,420	1,732
Total June 17, 1944	443	261	45	137	1,637,057	8,963	7,342	7	0	2	81	90	180	14	55	1,368	1,617

Service wells included: *13, †29, ‡2, §1.

Smackover plays in southern Arkansas west of Union County, since results have been poor. Some geologists have been inclined to suspect a connection between the increase in redness of the Cotton Valley and poor Smackover results, the idea being that perhaps the Cotton Valley is the source of the Smackover oil.

Now there will probably be a tendency to consider the whole Jurassic belt as generally potential Smackover territory, with interruptions due only to local conditions. Hence the area around the Monroe platform may also be reconsidered in the light of the development at Tinsley.

A Smackover lime play in Mississippi would probably trend generally north of the present salt dome exploration for Eutaw and Tuscaloosa production, since the intervening sedimentary section is so thick it would put the Smackover entirely too deep in most places.

EASTERN TEXAS

Wood County Test Is Possible 100-Bbl. Well

DALLAS.—Bobby Manziel 1 C. F. Parker, J. Stark Survey, second test in the Merigale sub-Clarksville pool of northern Wood County, 2 miles east of Quitman, was preparing to take official test after encountering a broken saturated sand at 4,876-4,965 ft. It is considered good for 100 bbl. of oil per day. Sub-Clarksville was topped at 4,872 ft., and total depth is 4,985 ft. Three-fourths of a mile southwest of 1 Parker, Bobby Manziel has started his 1 C. L. Shamburger, Stark Survey.

Skelly Oil Co. 1 Sallie Baker, wildcat in the Timothy Davis Survey, 1½ miles west of Deadwood, Panola County, was completed on a 24-hour official test for 41,000,000 cu. ft. of gas in the upper Pettit at 5,869-92 ft. and for 28,500,000 cu. ft. of gas in the Lower Pettit at 6,196-6,216 ft. Total depth is 6,246 ft.

Hunt Oil Co. 1 G. F. Bright, J. English Survey, 11 miles northeast of Center, Shelby County, cored at 6,324-46 ft. and recovered good gas odor and bleeding oil. Core at 6,375-85 ft. showed slightly porous to non-porous lime with gas odor. Total depth is 6,385 ft. Operator was preparing to run a drill-stem test. Humble Oil & Refining Co. 1 Pickering Lumber Co., wildcat in the Francois Survey, Shelby County, was drilling below 9,088 ft. in hard sand. Shell Oil Co., Inc., and Lone Star Production Co. 1 Tandy, W. Martin Survey, deep test in the Buffalo Woodbine area, Leon County, topped Travis Peak at 10,084 ft. and was drilling below 10,218 ft. in sand.

EASTERN TEXAS WILDCAT FAILURES

Hill County: Ray T. Rimer 1 R. A. Norton, J. M. McCarter Sur., 1 mi. SW Covington, elev. 716 ft., dry in Comanchean, TD 580 ft.

Hunt County: N. G. Landrum 1 W. H. Adams, H. T. Chenowith Sur., 3 mi. SE Royse City, elev. 580 ft., dry in Woodbine, TD 3,006 ft.

Upshur County: W. W. Bradley et al 1 R. W. Simpson, J. J. Hooper Sur., 1 mi. E Gilmer, elev. 346 ft., dry in Paluxy, TD 5,262 ft.

SOUTH LOUISIANA

Calcasieu Parish Test Flows 551 Bbl. Per Day

NEW ORLEANS.—Gulf Refining Co. 1-A Louisiana Sulphur Mining Co., 33-9s-11w, opened production on south flank of the Edgerly dome in Calcasieu Parish, flowing 551 bbl. per day through a ⅛-in. choke, tubing pressure 700 lb., through perforations at 9,325-50 ft. This well was drilled to a total depth of 9,520 ft. in shale with 5½-in. casing set to 9,398 ft.

Humble Oil & Refining Co. is completing its 5 I. R. Price on the Delta Farms field of Lafourche Parish. Drilled to a total depth of 9,495 ft. with 5½-in. casing set at 9,477 ft., the well is flowing 12 bbl. an hour through ¼-in. choke, tubing pressure 300 lb., gas-oil ratio 560 to 1. Production is from perforations at 9,420-26 ft.

The Texas Co. 2 State-Delta Farms, 31-16s-23e, at Delta Farms field, Lafourche Parish, flowed a potential of 110 bbl. per day through ⅛-in. choke, from perforations at 9,000-35 ft. Tubing pressure 790 lb., gas-oil ratio 513 to 1, gravity 35.6°. Total depth is 9,620 ft. with 7-in. casing set on bottom.

Humble completed a new well at 5-B Wilbert Mineral Corp., 76-8s-8e, at Bayou des Glaise field in Iberville Parish. It is flowing 14 bbl. an hour on 5/32-in. choke, tubing pressure 1,660 lb., gravity 36.2°, gas-oil ratio 729 to 1. Production is from perforations at 9,886-9,912 ft. Total depth is 9,941 ft., with 5½-in. casing set at 9,941 ft.

Sun Oil Co. and Sohio Petroleum Co. 2 Freeland pool, 29-9s-1w, at Egan field in Acadia Parish, is testing in 24 perforations at 10,749-55 ft. and is flowing 8 bbl. an hour through ⅛-in. choke, tubing pressure 1,625 lb., gravity 34°, packer set at 10,686 ft. Total depth of this well is 10,780 ft. in shale and 7-in. casing was set for the completion attempt.

Atlantic Refining Co. 5 Adeline Sugar Factory Co., 19-13s-9e, at North Jeanerette field in St. Mary Parish, flowed a potential of 259 bbl. per day through ⅛-in. choke from squeezed perforations at 11,430-38 ft. Gravity was 34.1° and gas-oil ratio 3,290 to 1. Total depth is 12,250 ft. with 5½-in. casing set at 12,241 ft.

Fohs Oil Co. 1 Simon-Campbell unit, 36-11s-1w, at Gueydan field in Vermilion Parish, flowed 595 bbl. of 33° gravity oil daily through 38/64-in. choke, gas-oil ratio 480 to 1, tubing pressure 180 lb., casing pressure 325 lb. Total depth is 10,299 ft., 5½-in. casing set to 10,298 ft., with perforations at 10,176-216 ft.

SOUTH LOUISIANA WILDCAT FAILURES

St. Martin Parish: Yegua Corp. 1 Guchereau et al, 71-9s-5e, dry at 11,660 ft.

Terrebonne Parish: Sun 1 Realty Operators, Inc., 72-17s-16e, dry at 11,540 ft.

MICHIGAN

Deep River Field Gets 200-Bbl. Well

SAGINAW.—Nine of 17 completions in Michigan in the past week were wildcat tests. All were failures, as were three other tests in proven territories. New producers included another 200-bbl.-per hour well in Arenac County's Deep River field. One small natural gas well also was completed. Thirteen new drilling permits were issued by the state conservation department, three for Allegan County, two each for Arenac and Kent, one each for Bay, Ottawa, Schoolcraft, Montcalm, Osceola and Ogemaw counties.

MICHIGAN WILDCAT FAILURES

Allegan County, Fillmore Township: Neil Wagenaar 1 Willink, SW NW SW 19-4n-15w, dry in Traverse limestone, TD 1,488 ft.

Gun Plains Township: R. B. Tamblyn Development 1 F. A. Parker, SW NE SW 20-1n-11w, dry in Traverse limestone, TD 1,515 ft.

Arenac County, Mason Township: American Drilling 1 Erwin Curriston et al,

DAILY AVERAGE PRODUCTION FOR WEEK

	June 16 crude oil	Distillate, allied products	June PAW quota all oils	June 9 crude oil
Alabama	700	.....	400	700
Arkansas	78,700	5,000	85,000	79,150
California	947,250	60,200	1,007,200	940,350
Colorado	11,500	.....	10,500	11,250
Eastern	62,250	6,400	70,600	62,800
Illinois	200,200	12,000	212,000	200,400
Indiana	12,000	.....	13,000	11,800
Kansas	275,150	4,100	278,100	250,050
Kentucky	29,800	2,200	30,200	28,700
Louisiana	368,000	42,500	402,500	368,100
North Louisiana	69,050	.....	.....	69,150
South Louisiana	298,950	.....	.....	298,950
Michigan	48,150	700	47,700	48,200
Mississippi	52,000	.....	53,000	51,750
Montana	23,100	300	23,300	23,100
Nebraska	900	.....	1,000	900
New Mexico	104,300	5,000	110,000	104,350
Oklahoma	386,350	28,000	398,000	387,400
Texas	2,180,450	163,000	2,333,000	2,180,450
East Texas	377,600	.....	.....	377,600
East Central Texas	139,900	.....	.....	139,900
North Central Texas	154,650	.....	.....	154,650
Texas Panhandle	90,000	.....	.....	90,000
West Texas	497,550	.....	.....	497,550
Southwest Texas	357,700	.....	.....	357,700
Texas Gulf Coast	563,050	.....	.....	563,050
Wyoming	101,450	3,100	116,600	100,250
Total United States	4,882,250	332,500	5,192,100	4,851,050
Change from previous week	up 31,200			

Total production January 1-June 16, 1945 ..... 799,610,750 bbl.
Same period last year ..... 745,569,961 bbl.

SW NW NW 26-20n-5e, dry in Dundee, TD 2,963 ft.

Mecosta County; Mecosta Township: Pure Oil 1 Bertha Meyer, NW NW SW 30-14n-10w, dry in Traverse limestone, TD 2,992 ft.

Missaukee County, Aetna Township: Gordon Oil A-1 State-Aetna, SW NE SE 15-22n-6w, dry in Dundee, TD 4,037½ ft.

Newaygo County, Barton Township: Michigan Consolidated Gas 1 Justus Chapman et al, SW 29-16n-11w, dry, TD 1,151 ft.

Otsego County, Hayes Township: Sun Oil 1 Esbern Hanson, trustee, NE 20-29n-4w, dry in Alpena, TD 1,940 ft.

Saginaw County, Thomas Township: Rowmor Corp.-Wilson Petroleum 1 Ida Malone, SE NE SE 7-12n-3e, dry in Dundee, TD 3,614 ft.

Van Buren County, Bangor Township: Miller Oil 1 Zordan, NE SW SW 26-2s-16w, dry in Traverse limestone, TD 1,013 ft.

TEXAS GULF COAST

Polk County Gets Big Dual Sand Completion

HOUSTON.—The Jordan Drilling Co. completed 1 Sodak Oil Co. at Livingston field in Polk County as an excellent dual sand well. Total depth is 6,719 ft., with 5½-in. casing set at 6,719 ft., 2-in. tubing at 6,622 ft. The well flowed a potential of 507 bbl. per day on ¼-in. choke through perforations at 6,380-6,540 ft., casing pressure 725 lb., gas-oil ratio 532 to 1, gravity 36°, 0.1 per cent water, and made 455 bbl. per day through perforations at 6,632-76 ft. on ¼-in. choke, tubing pressure 665 lb., gas-oil ratio 550 to 1, 0.2 per cent water. Gravity of the oil from both pays was 36°.

Production was extended ¼ mile to the southwest in the Southeast Fannett area, Jefferson County, by Glenn H. McCarthy 1 Mary Weed Fletcher, in Wm. H. Smith Survey 1-41, which was completed flowing a potential of 249 bbl. per day through 9/64-in. choke, tubing pressure 800 lb., casing pressure 1,200 lb., gravity 35°, 0.2 per cent water, gas-oil ratio 672 to 1, through perforations at 7,218-22 ft. Top of sand was at 7,197 ft., total depth 8,014 ft.

Glenn H. McCarthy 1 Craigen et al, in David Burrell Survey, Abstract 68, also in Southeast Fannett area, in Jefferson County, was completed flowing a potential of 201 bbl. per day on 9/64-in. choke through perforations at 7,325-30 ft. and 7,334-37 ft. Gas-oil ratio was 601 to 1, tubing pressure 900 lb., gravity 36°, 0.2 per cent water. Top of sand was 7,322 ft., total depth 7,677 ft.

General Crude Oil Co. 1-B Sun-Stanolind, in Augus McNeil Survey, an extension test west of production in the South Esperson field of Liberty County, was dry at total depth of 6,962 ft. An electric log was run in this test but no shows were reported.

Magnolia Petroleum Co. 2 Warren Ranch, a wildcat in Joshua Hudson Survey, on flank of the Hockley dome, Harris County, is coring ahead from 6,263 ft. This test recovered 2,400 ft. of 36° gravity oil on drill-stem test at 5,684-5,731 ft., using ¼-in. choke, open 8 hours. It had showed a maximum working pressure of 150 lb. but pressure declined at end of the test.

UPPER GULF COAST WILDCAT FAILURES

Harris County: Houston Oil of Texas 1 Carter Investment Co., in Talbott Patching Sur., Abstract 619, 5 mi. SW Sheldon, dry at 6,524 ft.

Wharton County: El Campo Rice Milling Co. 1 John Mach, I&GN Sur., Abstract 252, 1 mi. E of El Campo, dry at 6,265 ft.

N. CENTRAL TEXAS

Young County Wildcat Completes for 400 Bbl.

WICHITA FALLS.—Kerlyn Oil Co. 1 Bravousett, wildcat in the Ann Wood Survey, 5 miles north of Loving in northeast Young County, topped the pay at 5,041 ft. and was completed for 399.6 bbl. of 43° gravity oil in 8 hours. Gas-oil ratio was 666 to 1. Total depth is 5,080 ft. Sussex Oil 1 Wilday, west extension to the Wood Bend conglomerate pool of northwestern Clay County, took a 1-hour drill-stem test at 5,877-5,951 ft., showed gas in 14 minutes, and recovered 1,850 ft. of oil.

Jack County.—Continental Oil Co. 1 Mrs. J. W. Evans, extension to the Risch Bend conglomerate pool, recovered 1,700 ft. of heavily oil-cut mud on a 60-minute drill-stem test from 4,368-85 ft. It was preparing to perforate after drilling to 4,500 ft. in lime. Continental 1 S. F. Borden, E. S. Wilson Survey, a 7,000-ft. wildcat, 5 miles southeast of Newport, was drilling below 5,236 ft. in shale and lime. Continental 1 Roy Cherryhomes, J. Irvine Survey, wildcat 10 miles northeast of Jacksboro, drilled lime with stain and odor of oil at 6,642 ft. It was drilled to 6,672 ft in lime and will run a drill-stem test.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Eph Griffin and Staley Oil 1 C. H. Spain, Lot 6, G. P. Meade

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"55" Pasture, 4 mi. E and 1 mi. N Megargel, dry, TD 1,402 ft.

Jack Wilder 1 J. H. Robertson, Lot 14, J. W. Harris subd. of Club Ranch, elev. 1,089 ft., dry, TD 1,450 ft.

Cooke County: Texas 1-S L. A. Hutson, SPRR Sur. A-970, 8 mi. W and 2 mi. S Marysville, elev. 961 ft., dry in granite, TD 4,240 ft.

Foard County: Mid-Continent 1 Tom L. Burnett, Sec. 9, Blk. L, SPRR Sur., 6 mi. N Johnson pool, elev. 1,882 ft., dry in Strawn, TD 6,830 ft.

Jack County: Roeser & Pendleton and Kirk Johnson 1 W. Williams, Joseph Turner Sur. A-609, 14 mi. SE Jacksboro, elev. 1,242 ft., dry in Strawn, TD 3,083 ft.

King County: Mid-Continent 1 S. B. Burnett, G. W. Lampson Sur. A-247, 3 mi. SW Ross pool, elev. 1,836 ft., Ellenburger 6,243 ft., dry, TD 6,314 ft.

Throckmorton County: Bridwell Oil 1 J. C. Irvine, E. E. Irwin Sur., 1 mi. W and 6 mi. N Ft. Griffin, dry, TD 1,246 ft.

Young County: C. B. Christie et al 1 Marion Henderson, Jno. A. Hill Sur. A-127, 1 mi. E McLaren, elev. 1,129 ft., dry, TD 2,749 ft.

WEST CENTRAL TEXAS

ABILENE.—Ted Weiner and Lico, Inc. No. 1, D&DAL Survey, prospective King sand pool opener in northeastern Jones County, 2 miles southwest of Avoca, topped the King sand at 2,117 ft. It was drilled to 2,122 ft. with oil coming into the hole while drilling to total depth. Casing was set at 2,117 ft. and it was being tested. S. C. Herring 1 Clark, northwest extension to the Reddin field in Taylor County, pumped 122.4 bbl. of oil in 7 hours from the Gunsite at 2,604-14 ft.

Humble Oil & Refining Co. will drill a 7,500-ft. wildcat in Parker County, 1½ miles southeast of Peaster. It is 1 C. H. Tompkins, 660 ft. from the north line and 2,025 ft. from the east line, Section 169, T&P Survey A-1362.

WEST CENTRAL TEXAS WILDCAT FAILURES

Jones County: Phillips 1 Pearl, Sec. 17, Blk. 16, T&P Sur., 5 mi. SW Hawley, elev. 1,663 ft., dry, TD 2,505 ft.

Stephens County: Cherry & Barren Kidd 1 C. B. Waller, TE&L Sur., 8 mi. W Breckenridge, elev. 1,216 ft., dry in Ellenburger, TD 4,351 ft.

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EQUIPMENT ENGINEERS

PERMIAN BASIN

Cochran Co. Discovery Continues to Test

MIDLAND.—Stanolind Oil & Gas 1 J. F. Edwards, San Andres discovery in southwestern Cochran County, 11½ miles west of the Rhodes pool, was plugged back to 5,085½ ft. from total depth of 5,111 ft. After flowing and swabbing at the rate of 11 bbl. of fluid per hour for 6 hours, cut 3 per cent to 8 per cent basic sediment, 12 per cent water, and the balance new oil, it started flowing. It flowed for 1½ hours, making 19½ bbl. of oil. The well was shut in for 12 hours, then swabbed 2¾ bbl. of water in 1 hour, and then 13.7 bbl. of oil in 1 hour and died. Operator is continuing to test. Ten miles northeast of Stanolind 1 Edwards, Texas Gulf Production Co. has staked 1 Allie Slaughter, a 5,300-ft. wildcat. It is 6,388 ft. from the east line and 6,135 ft. from the north line of League 113, Potter County, School Lands Survey. The wildcat is also 3 miles west of the Slaughter pool. Stanolind 1 E. L. Slaughter, wildcat 1½ miles south of Morten in northeastern Cochran, is reported to be dry at 10,840 ft.

Humble Oil & Refining Co. 1 Parrott, deep discovery in eastern Upton County, was plugged back to 9,943 ft. In 5 hours it had swabbed 15 bbl. of fluid, 75 per cent oil, 25 per cent water. The well had been treated with 8,000 gal. of acid in two stages through perforations at 9,100-9,893 ft. Pump was being installed. Humble 1 Gresham, wildcat 1 mile west of 1 Parrott, was drilling below 9,011 ft. in shale.

Ector County.—Sinclair Prairie Oil Co. 1 Williamson, wildcat 3 miles northwest of the TXL pool, on a 30-minute drill-stem test at 7,938-8,029 ft. recovered 300 ft. of gas-cut drilling mud. It was drilling below 8,041 ft. in lime. Phillips Petroleum Co. 1-B TXL, ½ mile north of production in the southeastern part of the TXL pool, made an 80-minute drill-stem test at 7,947-94 ft. Gas came to the surface in 4 minutes. Oil started flowing in 20 minutes. It flowed 32 bbl. of 38.3° gravity oil during the next hour. It is waiting on cement to set. Shell Oil Co., Inc. and Cities Service Oil Co. 1-B TXL, 1½ miles south of the Devonian discovery in the pool, ran a 74-minute drill-stem test at 8,082-8,110 ft. It had gas to the surface in 3 minutes, flowed mud in 10 minutes and oil in 11½ minutes. It was turned into tanks after 14 minutes and flowed 69 bbl. of oil during the next hour.

Standard Oil Co. of Texas 1-X Durgin, deep test in the shallow production of the South Ward field in Ward County, is dry in the Mississippian at 10,010 ft., with no shows reported. Atlantic Refining Co. 1-A University, wildcat 6 miles west of the McElroy pool in eastern Crane County, took a 95-minute drill-stem test in the lower Devonian at 8,564-8,650 ft., had gas

(Continued on page 162)

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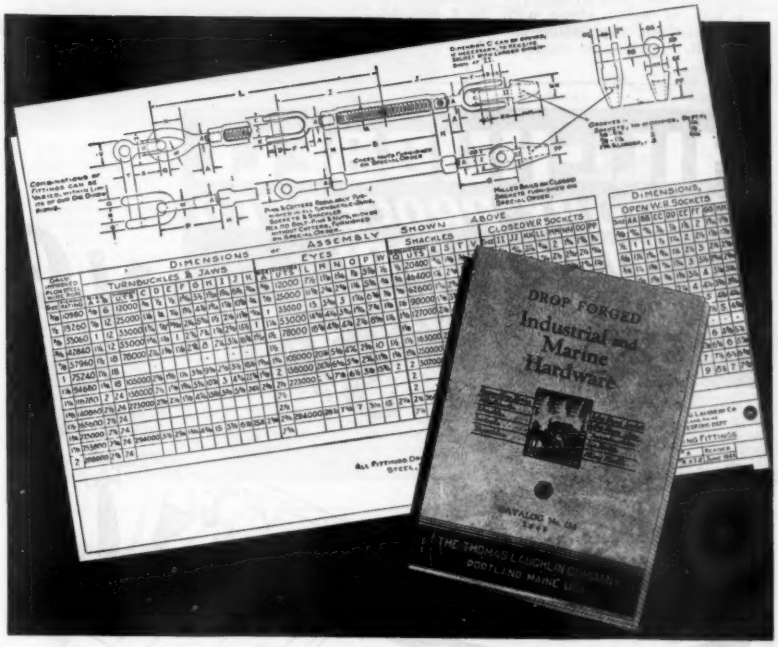

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LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

ILLINOIS

Dry Holes Nearly Equalled New Productive Wells

CENTRALIA.—The 17 oil wells reported completed in Illinois during the past week made a rather low average in initial production per well. The largest of the new crop was a 295-bbl. completion in the Clay City Consolidated pool, Pure Oil Co. 2 Hoard, NW NE SE 23-2n-7e, producing from McClosky lime at 2,997-3,003 ft. The average initial per well during the week was 108 bbl. Ten wildcats were dry and the lone productive wildcat made 5 bbl. of water along with its 5 bbl. of oil. Sixteen dry holes in all were reported.

Phillips Petroleum Co. was preparing to test 1 Oscar Tait, SW SE SW 5-3s-10e, Edwards County wildcat, which showed good saturation in McClosky lime at 3,249-54 ft. A 19-hour drill-stem test developed 2,040 ft. of clean oil, 120 ft. of oil-cut mud and 360 ft. of salt water. The well is 1¼ miles from production in the West Grayville pool.

J. W. Carter 1 O. C. Borah, NW NE NW 20-2n-10e, Richland County, was swabbing oil at the rate of 125 bbl. per day from McClosky lime at 3,199-3,203 ft. It is 2½ miles from production. It was not yet a completion.

ILLINOIS SUCCESSFUL WILDCAT COMPLETION

Wayne County: Magnolia 1 Borah, SW SW SW 4-1s-9e, Rosiclaire lime 3,340-45 ft., acidized with 3,000 gal. Pumped 5 bbl. of oil, 5 bbl. water, TD 3,362 ft. New pool.

ILLINOIS WILDCAT FAILURES

Clay County: H. Luttrell 1 Phillips, SW NW SW 11-4n-7e, dry at 3,041 ft. Tar Springs 2,324 ft., Barlow 2,551 ft., Aux Vases 2,810 ft., McClosky 2,990 ft.

Lawrence County: Parriott & Sprowls 1 Warner, NW NE SW 26-5n-12w, dry at 1,257 ft. No log.

J. S. Young, Jr. 1 Lewis, SW SW SE dry at 2,837 ft. Menard 1,956 ft., Cypress 2,455 ft., Benoist 2,596 ft., Ste. Genevieve 2,762 ft., McClosky 2,814 ft.

Marion County: S. C. Jarvis 1 Hawkins, SE SW NE 35-1n-1e, dry at 2,509 ft. Barlow 1,982 ft., Cypress 2,026 ft., Benoist 2,173 ft., Aux Vases 2,243 ft., McClosky 2,468 ft.

Standard Drilling 1 Kuntsman, SW SE NE 9-1n-4e, dry at 3,008 ft. Lower Kinkaid 1,876 ft., Cypress 2,558 ft., Benoist 2,674 ft., Aux Vases 2,794 ft., McClosky 2,925 ft.

Perry County: Magnolia 1 Armstrong, SW NE SW 8-6s-3w, dry at 1,699 ft. Menard 834 ft., Cypress 1,292 ft., Benoist 1,444 ft., Aux Vases 1,562 ft., Ste. Genevieve 1,616 ft.

Washington County: H. S. Williams 1 Krelling, SE NW NW 3-1s-1w, dry at 1,500 ft., Glen Dean 1,160 ft., Cypress 1,380 ft., Bethel 1,491 ft.

Wayne County: Nash Redwine 1 Crews, SE SE SE 6-2s-9e, dry at 3,396 ft. Upper Glen Dean 2,713 ft., Cypress 2,941 ft., Ste. Genevieve 3,290 ft., McClosky 3,351 ft.

C. E. Brehm 1 J. M. Tully, NE NW SW 23-2n-5e, dry at 3,045 ft. Menard 2,173 ft., Cypress 2,571 ft., Benoist 2,755 ft., Fredonia 2,941 ft., McClosky 2,951 ft., St. Louis 2,994 ft.

White County: Jarvis Bros. & Marcell 1 Hoskins, NW NW SW 31-6s-9e, dry at 3,342 ft. Lower Kincaid 2,146 ft., Barlow 2,862 ft., Aux Vases 3,152 ft., Ste. Genevieve 3,198 ft., McClosky 3,240 ft.

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CALIFORNIA

New Del Valle Well Flows 1,600-Bbl. Initial

LOS ANGELES.—Ohio Oil Co. completed an excellent flowing well in 13 Vaszuez at Del Valle during the past week and quite likely has proved up some additional locations to the south and east of this location. From all indications, Ohio completed this well in a new zone that may or may not prove to be extensive depending upon the degree of gradation encountered in future drilling. Ohio drilled this new well to 6,050 ft. and after landing 7-in. casing at 6,049 ft. went back and gun perforated an interval at 5,510-5,645 ft. It came in flowing at a daily rate of 1,600 bbl. with one run of the swab and was immediately pinched back to 350 bbl. daily. The productive interval in this new well is between the Sepulveda zone in the Pliocene-Miocene contact and the Vasquez of upper Miocene age. The interval was a shale in adjacent wells, clearly indicating a maximum gradation of formation, a dominating characteristic of this field. Geographically, Ohio's new well is located in the San Martinez section of the Del Valle anticline which comprises that productive area west of the leases being developed by R. E. Havenstrite. The well is located within 330 ft. of Havenstrite's Barnes lease and within 500 ft. of the north line of fee acreage held by Pacific Western Oil Co. Because of the proxmity of this new well to the Barnes and Pacific Western's acreage it is quite likely both will undertake offset drilling in the immediate future.

Chanslor Canfield Midway Oil Co. has set a new deep drilling record for the Rincon field of Ventura County but at 11,090 ft. was still looking for a new pro-

(Continued on page 162)

PENBERTHY

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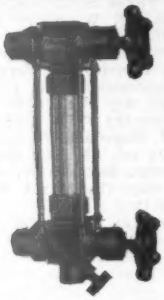

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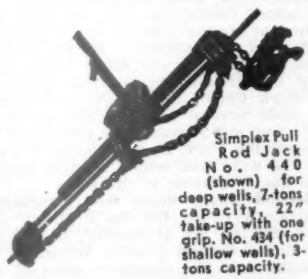

Simplex Pull Rod Jack No. 440 (shown) for deep wells, 7-tons capacity, 22" take-up with one grip. No. 434 (for shallow wells), 3-tons capacity.

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Royal Crown PUMP VALVE — MADSEN IRON WORKS

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SOUTHWEST TEXAS

Brooks County Test Makes Condensate Well

CORPUS CHRISTI.—A new gas-condensate discovery was completed by The Texas Co. at its Mary M. Lasater, in Brooks County, 5 miles southeast of Falfurrias, in the "Loma Blanca" Francisco Guerra Chapa Grant. On final gage the well flowed 28 bbl. of fluid, 28 per cent salt water and 72 per cent condensate, through 3/16-in. choke, tubing pressure 2,325 lb., gas-oil ratio 72,000 to 1, and 4,500,000 cu. ft. of gas daily on open flow test. Production is from 24 perforations at 6,656-60 ft. Total depth 8,518 ft. with 5½-in. casing set at 6,735 ft.

Hiawatha Oil & Gas Co. completed its 35 Southland Life Insurance Co., Southland field, Duval County, in Section 11, for a potential of 75 bbl. per day flowing through ⅛-in. choke, tubing pressure 340 lb., no water, gravity 42°. The gas-oil ratio is 206 to 1. Production is from 24 perforations at 3,955-59 ft., total depth 4,001 ft., with 5½-in. casing set at 3,997 ft.

Humble Oil & Refining Co. 10 King Ranch-Jinson, Tijerina field, Jim Wells County, on a 24-hour potential test flowed 47 bbl. through a ⅛-in. choke, tubing pressure 2,800 lb., gas-oil ratio 3,320 to 1, through perforations at 7,092-95 ft. Total depth is 7,370 ft., with 5½-in. casing set at 7,162 ft.

SOUTHWEST TEXAS SUCCESSFUL WILDCAT COMPLETION

Brooks County: Gas discovery—Texas 3 Mary M. Lasater, in Loma Blanca, Francisco Guerra Chappa Grant, 5 mi. SE Falfurrias, TD 8,518 ft., perf. 6,656-60 ft., PT 28 bbl. fluid daily, 3/16-in. choke, gas-oil ratio 72,000, and 4,500,000 cu. ft. gas, open flow, tubing pressure 2,325 lb., 28 per cent water.

SOUTHWEST TEXAS WILDCAT FAILURES

Duval County: Argo Oil 1 Mrs. Annie M. Bagnall, Survey 249, 10 mi. N Benavides, dry at 5,310 ft.

LaSalle County: Quintana Petroleum 5-F South Texas Syndicate, T. W. House Sur. 45, SE Washburn field, dry at 5,500 ft.

San Patricio County: Plymouth Oil 1 Ruth Patrick Pitman, Taft Farm Lands, Second Subdivision, Sec. 7, Lot 5, 3 mi. NE Taft, dry at 6,010 ft.

Victoria County: F. A. Gillespie & Sons 1 J. W. Ragsdale, Fernando De Leon Sur., 5½ mi. SE Inez, dry at 6,815 ft.

Webb County: Texas 1 W. R. Nicholson, BS&F Sur. 479, 23 mi. W Freer, dry at 7,014 ft.

Zapata County: Dulup Oil 1 San Juan Ramirez et al, Sur. 7, 10 mi. S Petro, dry at 1,961 ft.

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ROCKY MOUNTAIN

New Mexico Deep Test Shows Oil Saturation

DENVER.—Transcal Petroleum Corp. 1 Davidson, NW NW 28-28n-10w, Kutz Canyon field, San Juan County, northwest New Mexico, showed good oil saturation with considerable gas in an 8-ft. sand encountered approximately 100 ft. above the objective Point Lookout sand. Attempts to make a drill-stem test were unsuccessful due to difficulty in finding a suitable place to set the packer, and coring was resumed at 4,400 ft. The importance of this wildcat is emphasized by its location out in the deep San Juan basin east of the Hogback and Rattlesnake fields where high-gravity crude is produced from the Dakota sands at 700 to 1,000 ft. Numerous shallow wells showing gas and small quantities of crude have been drilled within a radius of 25 miles of this test, but due to the rapid dip of the formations toward the east, few deep tests have been drilled in the heart of the basin. Kutz Canyon produces gas from the Picture Cliff sand of upper Cretaceous age, the pay being found at around 2,000 ft. The Point Lookout sand, the objective in the Transcal test, is in the lower Mesa Verde group and is estimated to be from 250 to 300 ft. thick. Coring for this formation started in shale several hundred feet above the objective and it was while feeling its way toward the Point Lookout sand, it picked up the 8-ft. sand which showed good oil and gas saturation in the cores.

Second Bailey dome well completed.—Sinclair-Wyoming Oil Co. 2 Milton Coffman, SE NW NE 21-26n-89w, on the Bailey dome, Carbon County, Wyoming, was completed in the Sundance sand at 5,204 ft., total depth, and flowed 674 bbl. in 24 hours through perforations. Top of Sundance was at 5,132 ft. This was the second completion in this field and it is located ¼ of a mile west of the discovery completed early this year for 381 bbl. in 16 hours. The oil in the discovery tested 34.6° gravity. The test was headed for the underlying Tensleep, but stopped when good production was encountered in the Sundance. Development is proceding out from the discovery without any attempt at present to define the limits of the pool. The third well will be a diagonal offset on the north to the two completions.

WILDCAT FAILURE IN MONTANA

Glacier County, North Headlight Butte: Texas Co. 1 Tribal-283, SW SW 23-37n-6w, TD 3,439 ft., top Madison 3,379 ft., dry.

APPALACHIAN FIELD

West Virginia Test Flows 10 Million Gas

PITTSBURGH.—In Kanawha County, West Virginia, the test, United Fuel Gas Co. 5,584 Lenora G. Alexander, in Elk district, which was reported good for 6,000,000 cu. ft. gas from the Oriskany sand, total depth 5,303 ft., was drilled 4 ft. deeper in the sand with a resulting increase in volume to nearly 10,000,000 cu. ft., or almost equal to the Gebhart discovery east of the southern tip of the Elk-Poca Oriskany field.

In Union district, Barbour County, a good Benson sand gas well was completed as the result of a test on Hoffman Trimble farm by Hanley & Bird. It gaged 900,000 cu. ft. from total depth 4,350 ft.

In Nicholas County, Godfrey L. Cabot, Inc., completed test 1,176 C. B. Backus in Jefferson district good for 445,000 cu. ft. gas after shot. The Maxton sand was 1,387-1,407 ft., gas 1,402-07 ft., Big Lime 1,510-1,705 ft., gas 1,616 ft., Injun sand 1,729-1,790 ft., gas 1,762-72 ft., shot 1,753-75 ft., total depth 1,790 ft.

In Warren County, western Pennsylvania Northern Ordnance Co. reached the Red Medina at 5,370 ft. in the wildcat on Reeves tract, Southwest Township, from an elevation of 1,649 ft. The Tully lime was 3,849 ft., Onondaga lime 4,125 ft., Oriskany 4,195-4,208 ft., Niagara lime 4,868 ft., ½ bbl. water at 5,100 ft., drilling at 5,436 ft.

OHIO, KENTUCKY

Clayton Pool Extended Both East and West

COLUMBUS.—Small east and west extensions to the Clayton pool were completed by the Industrial Gas Co. In Section 3, Clayton Township, 2 Russel Cannon made 118 bbl. from Clinton at 3,357-3,387 ft. In Section 12, Reading Township, 10 Albert Wilson made 50 bbl. from sand at 3,152-3,186 ft.

A better than average well was completed in the Sandyville field by the Natural Gas Co. on the Muskingum W. C. District, Section 17, Pike Township, Stark County. Clinton sand at 4,633-4,661 ft. gaged 3,465,000 cu. ft. natural with 1,310 lb. pressure. In the extreme north part of the same field, Hanley and Bird have drilled in their 1 David Mattie, Section 22, Canton Township. The Clinton, topped at 4,695 ft., was drilled to 4,712 ft. with a gage of 1,050,000 cu. ft. A gage of 4,000,000 cu. ft. was taken one hour after shot.

OHIO SUCCESSFUL WILDCAT

Muskingum County, Newton Township: Ohio Fuel 1 Mary Butler, Section 5, Clinton 3,457-3,502 ft., 332,000 cu. ft., TD 3,508 ft.

OHIO WILDCAT FAILURES

Coshocton County, Lafayette Township: Ohio Fuel 1 M. S. Rehard, Lot 2, Clinton 3,947-3,990 ft., dry, TD 4,077 ft.

Muskingum County, Hopewell Township: Belmont Quadrangle 1 Oscar Riggle, Section 18, Clinton 3,331-3,387 ft., dry, TD 3,492.

Perry County, Thorn Township: Belmont Quadrangle 1 M. L. Lyle, Section 21, Clinton 2,608-2,635 ft., dry, TD 2,775 ft.

WESTERN KENTUCKY

OWENSBORO.—Seven oil wells and five dry holes were reported during the week in western Kentucky, the producers averaging 59 bbl. per well in initial production. Two wildcats were completed, both productive of oil.

A report from Todd County says Ekirk Associates 1 Stinson, near Elkton, the county seat, was showing for a producing well from Devonian lime topped at 1,389 ft. and drilled in only 3 ft. Oil rose in the hole 300 ft. in 3 hours while the cable tools were running. The well is about 35 miles from any oil production.

SUCCESSFUL WILDCAT COMPLETIONS IN WESTERN KENTUCKY

Henderson County: Kingwood 1 Sarah Archer et al, NW NW NE 23-P-27, near Hamilton Ferry, Jackson sand 1,541-59 ft. and Benoist sand 1,743-61 ft., TD 2,035, initial production 63 bbl. of oil. Between Birk City and Hebbardsville pools. May be an extension.

Union County: A. J. Slagter et al 1 Rose Hollis, 9-Q-30, 2 mi. NW of Maceo. Tar Springs 830-40 ft., TD 872 ft. Initial production 5 bbl. of oil.

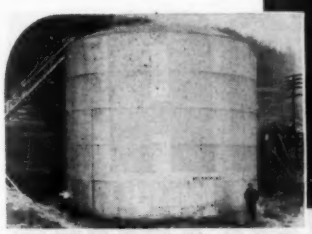
EASTERN KENTUCKY

ASHLAND.—One gas well and two oil wells were completed in eastern Kentucky during the week.

Kentucky-West Virginia Gas Co. completed No. 5,586 on the I. N. Akers property on Miller Creek in Johnson County. total depth was 2,844 ft., with a daily open flow of 88,000 cu. ft. of gas in Big Six and 21,000 cu. ft. of gas in shale.

R. B. Fannin and Sons completed No. 3 on the R. B. Fannin and Son farm in Elliott County, on Newcomb Creek, at a total depth of 941 ft., with estimated daily production of 8 bbl. of oil.

Henry Ball completed No. 18 on the Kate Sawyer property in Owl Hollow in Estill County, at a total depth of 540 ft., with estimated daily production of 2 bbl.



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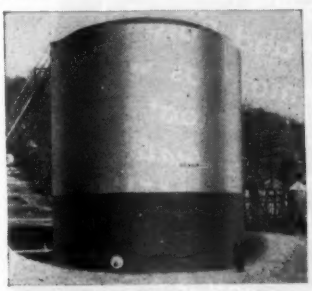
Above photo shows new capacity-increasing shell welded in position around old tank which is ready to be raised to top edge of newly installed plates.



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KANSAS

Barber County Test Has Oil in Hole

DRILLERS Gas Co. 1 Gant, SE NW SE 6-31-13w, a wildcat just north of Lake City pool in Barber County, is a prospective pool opener, or extension to the Lake City pool. After perforating at 4,532-35 ft. in the Maquoketa, topped at 4,533 ft., 1,200 ft. of oil rose in the hole. Pipe was set at 4,678 ft., and tops on the well are Mississippi lime 4,424 ft., Kinderhook 4,471 ft., Maquoketa 4,533 ft., Viola 4,538 ft., Simpson sand 4,673 ft., and Arbuckle 4,743 ft.

Barton County: Black-Marshall 1 Willcutt, NW SE SW 2-19-15w, has set pipe at 3,607 ft., to test the Arbuckle. A five-foot core was taken at 3,612-17 ft., with a good gas odor and some oil stain. Some free oil was reported. The Arbuckle was cut at 3,604 ft., and the Reagan at 3,613 ft. This test is about ¾ mile east of production in the Merten pool.

KANSAS WILDCAT FAILURES

Barber County: J. M. Huber 1 Warner, E/2 NE SE 22-30-14w, dry, TD 4,795 ft., Arbuckle 4,788 ft.

Allidin and Landon 1 House, S/2 SE NW 22-30-12w, dry, TD 4,767 ft., Arbuckle 4,723 ft.

Barton County: Inland Oil 1 Arnold, SW SW SE 8-19-15w, dry, TD 3,683 ft., Arbuckle 3,659 ft.

Butler County: Ward McGinnis and Glen Smith 1 Teeter, SW SW SW 12-25-6e, dry, TD 2,791 ft., Mississippi lime 2,758 ft.

Cromwell and Lewis 1 Taliferro, NE NE SW 31-26-7e, dry, TD 2,775 ft., Mississippi lime 2,733 ft.

Marion County: Phillips 1 Bernhard, SE SE SW 24-21-1e, dry, TD 3,484 ft., Arbuckle 3,454 ft.

Norton County: Bridgeport 1 Riemann, NE NE NE 10-5-21w, dry, TD 3,620 ft., Arbuckle 3,469 ft.

Pratt County: S.P.O. 1 Peters, NE NE SW 31-29-15w, dry, TD 5,160 ft., Arbuckle 5,085 ft.

Russell County: Mid-States et al 1 Ross, SE SE SW 25-12-15w, dry, TD 3,319 ft., Arbuckle 3,278 ft.

Simpson Noble 1 Oliver, NW SW 9-15-11w, dry, TD 3,362 ft., Arbuckle 3,311 ft.

Woodson County: C. R. Armstrong and Sauder 1 Miller, NE SW 17-24-14e, dry, TD 1,778 ft., Mississippi lime 1,650 ft.

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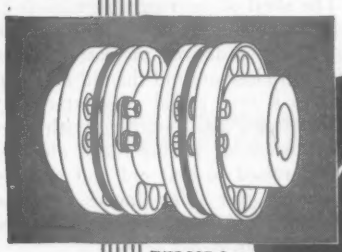

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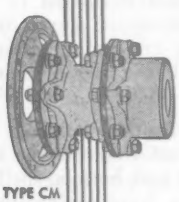

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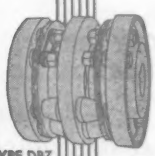

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THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

OKLAHOMA

Bethany Field in Cleveland County Is Extended

GULF OIL CORP.'S wildcat test in Kingfisher County, Oklahoma, 1 Triplett, C NE SW 8-15n-5w, which attracted considerable attention a week ago, did not look so good after plug was drilled and the well put on the swab. It showed only a rainbow of oil in the salt water recovered, and after a 4,500-gal. acid treatment failed to show that it was an oil well. Hunton lime was topped at 7,362 ft., total depth 7,392 ft. It was not yet completed.

Phillips Petroleum Co. et al 1 Ella, C NE NE 22-12n-4w, Oklahoma County, extended the Bethany field, producing 210 bbl. of 62.8° distillate in 21 hours, part of the time through tubing and part through small choke together with 16,800,000 cu. ft. of gas. The well was drilled to Wilcox sand at 7,728-56 ft., which was dry and the hole plugged back to 7,314 ft. Production comes from the Bois D'Arc section at 7,136-41 ft., where pipe had been perforated.

In the East Pauls Valley field in Garvin County, Midstates Oil Co. 1 Mann, SW NW SW 16-3n-2e, was drilled to 3,281 ft., with pipe set at 3,266 ft. Casing was perforated opposite the Brundidge sand at 2,958-68 ft. and 2,972-82 ft. The well flowed 610 bbl. through tubing in 24 hours and a later gage showed 426 bbl. in 11 hours through ½-in. choke and then 126 bbl. in 6 hours through 20/64-in. choke.

Carter Oil Co. has petitioned the Corporation Commission of Oklahoma for 160-acre well spacing in the Washington field in McClain County because of the very high cost of drilling and putting a well on production, and the low per-acre recovery expected. The petition was based on the performance of the discovery well, 1 Cunningham, C SE SW 4-7n-3w, drilled to a total depth of 11,209 ft. at a total cost of $349,925, and its 1 McBride in 9-7n-3w, which cost $276,000. The company estimates future drilling costs at $275,000 per well in that field. Hearing will be held on June 26.

OKLAHOMA SUCCESSFUL WILDCAT

Cleveland County: New oil pool—Mid-Continent 1 Turk, SW SW NE 29-10n-3w, OWPB, TD 8,981 ft., flowed 25 bbl. per hour from Bartlesville at 7,864-75 ft., Hunton (Bois d'Arc) 8,075 ft.

OKLAHOMA WILDCAT FAILURES

Blaine County: Superior 1 Norris, NE NE NE 17-19n-10w, dry, TD 11,008 ft.

Carter County: Fair 1 Martin, NW NW SW 34-3s-1w, dry, TD 1,709 ft.

Cleveland County: J. E. Tregg 1 Gray, SW NE 29-9n-1w, dry, TD 7,373 ft., Sylvan 6,910 ft.

Ed Kubat 1 Stotts, NW NW SE 2-6n-1e, dry, TD 6,463 ft., Wilcox 6,452 ft.

Cotton County: Grace and Grace 1 Tucker, SW SW SW 8-4s-10w, dry, TD 1,240 ft. in sand.

Creek County: Ed Kubat et al 1 Brown, NE NW NE 18-16n-8e, dry, TD 3,739 ft., Wilcox 3,693 ft.

Grant County: Derby Oil 1 Powell, NE NE NW 19-29n-5w, dry, TD 5,433 ft., Simpson 5,176 ft.

Lincoln County: Dudley Morgan 1 Wagoner, SE SW NE 33-17-6e, dry, TD 3,412 ft., May 3,400 ft.

Pawnee County: Transwestern 1 Bragda, NE SW SW 33-22n-3e, dry, TD 4,484 ft., second Wilcox 4,470 ft.

Payne County: Wilcox 1 Park, NW NW SE 19-18-2e, TD 4,951 ft., second Wilcox 4,904 ft.

Pittsburg County: Public Service 1 Martin, NW NW 15-8n-14e, dry, TD 1,491 ft. in sand.

Pontotoc County: M. C. Mitchell 1 Norman, SE NE SE 8-5n-4e, dry, TD 3,311 ft., Bromide 3,279 ft.

Delaney 1 Baird, SW SW 2-4n-6e, dry, TD 2,498 ft., Hunton 2,476 ft.

Pottowatomie County: K.G.F.F. and Atlantic 1 Bourbonnais, NW SW 31-10n-4e, dry, TD 5,354 ft., second Wilcox 5,330 ft.

Stephens County: Lundy and Shear et al 1 Thomas, SW SW NW 23-1n-6w, dry, TD 3,009 ft. in sand.

MISSISSIPPI

Probable Gas Discovery At 10,196 Ft.; Fishing

JACKSON.—Humble Oil & Refining Co. 1 Smith, SE SE SE 12-9n-1e, in Jefferson County, probable gas discovery, has drilled from 9,932 ft. to 10,196 ft. without additional shows of oil or gas, and are now fishing for drill collar and bit. The first two drill-stem tests taken, at 3,635-55 ft. and 3,683-88 ft., flowed gas, and a gas-condensate sand was cored at 9,680-9,722 ft.

In Highland County, Florida, Humble 1 Carleton estate has cored dense gray lime with a slight show of oil. The well is located in 34-38s-29e, and is about 60 miles north of the Sunniland field in Collier County. The oil show was at 8,901-35 ft., and coring is being continued below 8,935 ft.

MISSISSIPPI WILDCAT FAILURES

Clarke County: Carter 1 Long-Bell Petroleum, SW NE 14-4n-16e, dry, TD 4,770 ft., Massive sand 4,240 ft.

Jefferson County: Tide Water 1 Buie, 664 ft. south and 697 ft. east of NW cor. of Sec. 12-8n-4e, dry, TD 10,759 ft., Comanche 10,657 ft.

CANADIAN FIELDS

South Turner Valley Extension Makes 485 Bbl.

CHATHAM.—In the South Turner Valley extension, Imperial Oils, Ltd. Federated 1, LSD 16, 5-18-2w5, finished with Madison limestone at 8,227-8,447 ft., and has initial production of 485 bbl. after acidizing, somewhat larger than early estimates.

Conrad.—In the Conrad field, southern Alberta, California-Standard 15-32-B, LSD 9, 32-5-15w4, is in production, making 100 to 150 bbl. of 27° gravity oil from a 5-ft. sand in the Ellis, bottoming at 3,084 ft. California-Standard 15-35-B, LSD 9, 35-5-15w4, is dry after drilling into the Madison to 3,185 ft.

Coalspur.—In the northern Alberta foothills, Imperial Oils, Ltd.-Coalspur 1, LSD 10, 3-49-21w5, the deepest well in Canada, has halted drilling at 12,955 ft. and is preparing to test Madison limestone entered at 12,756 ft. Later tests will be made of heavy gas shows in the overlying Benton shale.

Lloydminster.—In the Lloydminster field, eastern Alberta, Borrodaile Oils 9, LSD 14, 12-49-1w5, has finished at 1,903½ ft. with initial production of 60 bbl. of 14° gravity crude.

LA.-ARK.

Second Producer For Longwell Field Flowing

SHREVEPORT.—The new Longwell field in Caddo Parish, Louisiana, had its second producer recently in Phillips Petroleum Co. 1 Leake, NE NW 32-19n-16w, a northern outpost of the discovery well, the Moneyham. On a drill-stem test, the well flowed between 100 and 125 bbl. of oil on ¼-in. choke, with a packer on the tubing. Production was from Travis Peak, at 5,880-6,000 ft., and the well is reported to have tested higher than the discovery well.

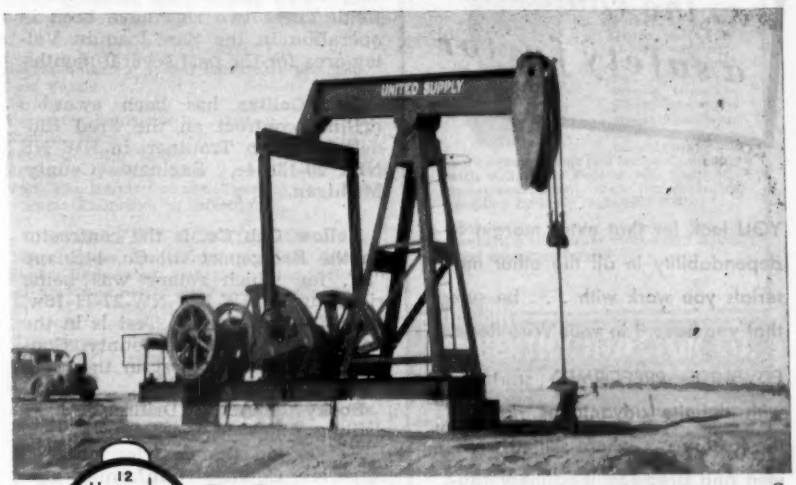
ARKANSAS WILDCAT FAILURE

Union County: Tide Water-Seaboard 1 Griffin, NW SE 33-18s-16w, dry, TD 7,919 ft.

NORTH LOUISIANA WILDCAT FAILURES

DeSoto Parish: A. J. Bankhead 1 Porter, 1,650 ft. north and 990 ft. east of SW cor. of SE 23-12n-13w, dry, TD 3,011 ft.

Rapides Parish: George W. Woodward 1 Thompson, 5-5n-3w, dry, TD 1,825 ft.



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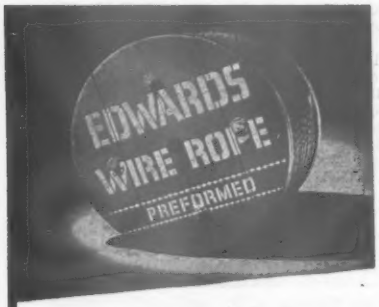

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Among the Drilling Contractors

Shamrock Drilling Co., Los Angeles, is preparing to drill two additional wells for Union Pacific Railroad Co., in the Wilmington, California, field, and expects to undertake additional drilling in the same field. These two rigs have been in operation in the San Joaquin Valley area for the past several months.

Jim Collins has been awarded drilling contract on the Fred Riddell 1 Edman Trautner, in NW NE NE 20-13n-4e, Saginaw County, Michigan.

Yellow Cab Co. is the contractor on the Bridgeport Oil Co. 1 Snapp "A", for which rotary was being rigged up in NW NW NW 27-11-16w, Ellis County, Kansas. Test is in the northeast part of the county. Contractor has an interest in the well.

Rocky Mountain Drilling Co. is drilling Amerada Petroleum Corp.'s 1 Veysey, in the Brawley area of Imperial County, California, and **O'Kane & Brain** are drilling Amerada's new wildcat in the El Centro district.

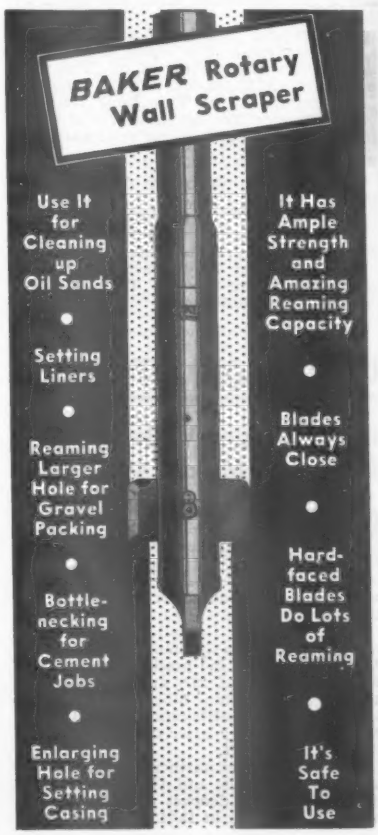
Fowler Drilling Co. is rigging up rotary tools for a new test to be drilled for Atlas Productions, Inc., in the Newport-Costa Mesa district of Los Angeles basin, California. Spud will be made within the next few days and drilling time will be 3 weeks or less.

Jamison & Pollard, Fort Stockton, Tex., has been awarded contract by the Cardinal division of Helmerich & Payne, Tulsa, and San Angelo, Tex., to drill four tests on its E. H. Shirk lease in the McCamey field in Upton County, Texas. The lease is in SE Section 5, Block 3, MKT Survey. The four tests are the company's 5, 6, 7, and 8 Shirk.

Don Ingling has the contract on the Globe Oil & Refining Co. 1 Rossler, in SW SW SE 30-18-9w, Rice County, Kansas, wildcat. This test, which was drilling below 2,000 ft., is approximately 1½ miles west of the Ploog pool production.

Helmerich & Payne, Inc., has completed its contract on The Texas Co. 1 Wirt, in NW NW SW 11-35-2w, Sumner County, Kansas, which was dry. The test was drilled to a total depth of 4,514 ft., and was approximately 6 miles east of the town of Caldwell. Helmerich & Payne has been awarded drilling contract on the Olney F. Flynn 5,200-ft. wildcat test in SW SE Section 213, Block 43, H&TC Railroad Survey, Ochiltree County, Texas. This is the first test on a block of 26,000 acres held by Flynn. Location is a mile west of James R. Macon's 1 Norris, which encountered gas pressure in the dolomite from 5,000-5,200 ft. in a test several years ago.

Veeder Supply Co. is the contractor on the Cities Service Oil Co. 1 Dechamp, in NW NW NW 27-13-19w, Ellis County, Kansas, and was moving in rotary. The test is about ½ mile northeast of the town of Yocemento, and is 2 miles south of the old Yocemento pool.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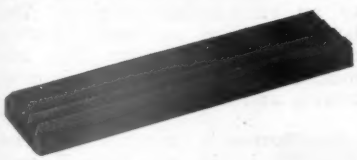

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Pages 3101 to 3120

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MARKET QUOTATIONS

Prices as of June 19, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	5.875
Gulf Coast	6.75	5.625
Northeast Coast	...	9.075
California	...	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	4.125	4.950
North Louisiana (f.o.b. plant)	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.09	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended June 9, 1945
(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Distillate	Stocks: Residual
East Coast	783	13,820	6,656	6,139
Appalachian	145	4,425	417	321
Ill., Ind., Ky.	752	20,440	4,654	2,135
Okla., Kan., Mo.	374	9,118	1,819	1,193
Inland Texas	244	3,021	373	891
Tex. Gulf Coast	1,138	13,957	5,274	5,004
La. Gulf Coast	267	4,260	1,679	1,190
North La., Ark.	89	2,474	786	172
Rocky Mt.	130	2,446	322	592
California	905	13,935	8,359	21,359
Total 6- 9-45	4,827	*87,896	30,339	38,996
Total 6- 2-45	4,804	88,696	29,819	39,022
Total 6-10-44	4,663	86,298	33,617	51,946

*Military 40,865, civilian 47,031.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
June 9, 1945	221,552,000
June 2, 1945	224,079,000
June 10, 1944	231,290,000

*Excludes unrefinable California stocks.

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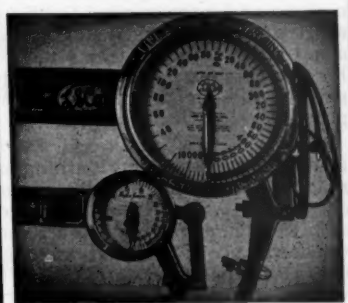
LINE SCALES



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PERSONALS

Howard Was Crack Thirdbaseman At College

OIL isn't the only thing that has engaged the enthusiastic interest of "Del" Howard, superintendent of production for Cities Service Gas Co. For instance, when he was a student at Cornell University he was a crack thirdbaseman on the college team. That's the way he came to be nicknamed for the original Del Howard, one of baseball's stars. Managers of professional teams bid for his services, and for a time he played with several major and minor league outfits.

Del, who was christened David Howard, was born in Washington, graduated from high school in that city, and after receiving his degree in civil engineering at Cornell entered the oil industry as an engineer for Empire Gas & Fuel Co., of which Cities Service is a subsidiary. Deciding that he wanted to know the business from the bottom, he obtained a transfer to the production department. Working in Oklahoma, Kansas, and Texas, he advanced from roustabout to a division superintendent. In January 1943 Howard was promoted to his present post, with supervision of production in those three states. As an avocation he studied law and has passed the Oklahoma bar examination.

Claud B. Hamill, independent oil operator of Houston, is the first member of that city's chamber of commerce in its 105 years to be awarded a life membership. The honor came as a result of his being the first man to bring 100 new members into the organization in 1 year. Hamill is the son of Curt Hamill, pioneer Spindletop oil-field driller, who brought in the famous Lucas well in 1901.

James M. Bolding, for the past 3 years a special agent of Federal Bureau of Investigation, is now associated with **P. N. Wiggins, Jr.,** independent oil operator of Dallas. Before entering government service Boling was in the land department of Lone Star Gas Co.

Dr. S. Fróes Abreau, of Rio de Janeiro, director of the mineral division, Instituto Nacional de Technologia, was in Tulsa recently, conferring with oil company executives with a view of stimulating interest in Brazil as an attractive field for exploratory work. His recommendation prompted the Brazilian Government to drill a test well, which opened the first and only oil field in his country.

Vernon B. Bottoms has resigned as district production engineer for Sinclair Prairie Oil Co. at Oklahoma City to become district petroleum engineer for The Superior Oil Co. at Midland, Tex.

M. L. Arnold, Richfield Oil Corp., has been elected president of California Natural Gasoline Association, and **M. W. Kibre,** General Petroleum Corp., vice president.

Charles G. Green, for the past 2 years acting assistant district geologist for Shell Oil Co., Inc., in Midland, Tex., has joined Texas Gulf Producing Co. in West Texas and New Mexico. His headquarters will continue to be in Midland. Green graduated from University of Oklahoma in 1937.

Milburn E. Anderson, of Warren, Pa., oil producer in the Bradford-Oil City areas in Pennsylvania, was an Oklahoma visitor last week. While here he was elected a director of the Indian Royalty Co. of Oklahoma City.

Joseph Jensen, chief petroleum engineer for Tide Water Associated Oil Co. with offices in Los Angeles, has been elected chairman of Conservation Committee of California Oil Producers. **H. S. Stark,** Honolulu Oil Corp., was chosen first vice chairman; **John Hancock,** Hancock Oil Co., second vice chairman; **Carlton Beal,** Richfield Oil Co., secretary.

Dan O. Howard, petroleum geologist, who resigned from the conservation department of the Oklahoma Corporation Commission in February 1944 to enter the Marine Corps, has returned to his former position. **Reford Bond,** chairman of the commission, said Howard had been released from military service at the commission's request, in order to obtain the benefit of his services.

Fred Oglesby, formerly district landman at Wichita, Kans., for British American Oil Producing Co., has been made head of the land department, succeding **John E. Watson,** who resigned.

F. B. Parriott, oil producer, has been elected a director of The First National Bank & Trust Co. of Tulsa. He replaces **A. I. Levorsen,** who went to California to become executive head of the geological department of Leland Stanford University. Parriott was president of Transcontinental Oil Co. until it was sold to The Ohio Oil Co.

Paul S. Clapp, vice president of Ohio Fuel Gas Co., has received from Iowa State College the Anson Marston Medal, awarded annually to an engineering alumnus. The honor is based on the graduate's record as a professional man, administrator, his participation in civic affairs, and in research.

Lee Burress is a new scout for The Texas Co. in Shawnee, Okla. He was transferred from the production department in Illinois.

Roscoe Simpson, engineer and geologist, who had been with Permian Basin Sample Laboratories, Midland, Tex., since last December, has rejoined Cardinal Oil Co. at San Angelo.

G. L. Rowsey, president of Taylor Refining Co., has been chosen president of Gulf Coast Refiners Association. Membership in Petroleum Industry War Council goes with the post. Rowsey is president also of Coastal Refineries, Inc.

Lloyd Haseltine, with Magnolia Petroleum Co. at Wichita Falls, has been elected president of North Texas Geological Society.

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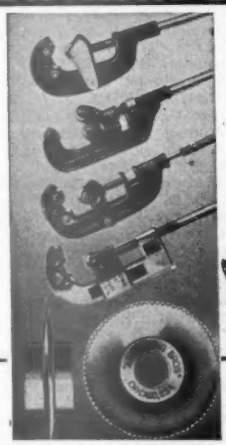
ARMSTRONG BROS.



All ARMSTRONG BROS. Pipe Cutters are made in all standard types. Each is a quality tool with hardened steel pins and rollers. "Saunders Type"—hardened end of thrust rod bears on inserted hard steel block (double life). In "Drop Forged" and "Combination" types, which take either 1 or 3 wheels, a replaceable hardened steel nut takes up thrust. In the "Barnes" type thrust rod threads through drop forged steel section.
ARMSTRONG BROS. Knife Blade Cutter Wheels (smooth or knurled) have thin penetrating edges that hold their keenness because they are machined from special vanadium tool steel, hardened and oil tempered. Fit all standard-make pipe cutters.
Write for Catalog

ARMSTRONG BROS. TOOL CO.
304 N. FRANCISCO AVE. CHICAGO, U.S.A.

Another Milestone . . . On the Road to Safety
...JUSTRITE

Wherever safety approved portable lights are required in the Petroleum Industry . . . Justrite Safety Lanterns and Flashlights are the first choice.

Model No. 17-S

Approved for Safety . . . Justrite The Lantern and Flashlight shown here have been tested for safety and approved by Underwriters' Laboratories, Inc., and U. S. Bureau of Mines for safe use in methane gas and air mixtures.

The New Handy-Safety Flashlight The Flashlight that fits in the palm of the hand, on belt clip or stands alone. 1500 candlepower . . . 3 standard cells for dependable service. Has all the famous Justrite Safety features "sealed-in" a sturdy plastic case. A "He-Man's" Flashlight that's . . . Justrite.

Model No. 44-S

All-Purpose Safety Lantern The Lantern that's specially designed for heavy duty. Twin-bulbs for dependable service . . . "kick-out" bulb sockets and spark-proofed guards to meet the highest safety requirements.

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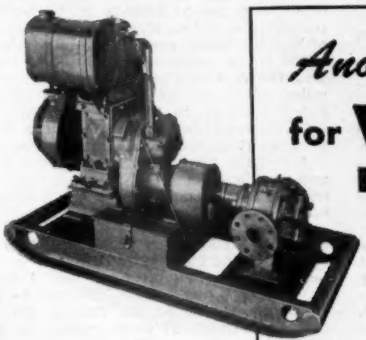

Another OIL FIELD JOB for WISCONSIN HEAVY-DUTY *Air-Cooled* ENGINES

In the Pauls Valley Field, in Oklahoma, you will find this heavy-duty pumping unit doing a first-class job of work for the Pure Transportation Company. The outfit consists of a 2-GR Worthington Pump, direct-connected to a Model AHH 4-cycle Single Cylinder Engine (7 to 9 hp.) through a Clutch Reduction Assembly, supplied by Wisconsin Motor Corporation as an integral part of the engine equipment.

The all-weather serviceability and extreme adaptability of Wisconsin Heavy-Duty Air-Cooled Engines to all types of equipment and service applications within a 1 to 30 hp. range have won for them a top rating with operators who don't want to fool around with anything but the "best" in oil field equipment.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

SUMMARY OF MAY COMPLETIONS*

	Comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500 ft.	2,500-5,000 ft.	5,000-10,000 ft.	Over 10,000 ft.	Total footage	Rigs and drilling
New York	119	60	200	0	†59	0	119	0	0	0	171,000	132
Pennsylvania	298	150	330	14	‡134	8	281	9	0	0	412,645	326
West Virginia	55	8	56	43	4	1	34	19	1	0	138,724	72
Ohio	70	18	297	31	21	7	28	34	1	0	173,802	180
Indiana	29	15	1,113	1	13	3	22	4	0	0	45,568	43
Kentucky	29	14	1,720	5	10	2	13	14	0	0	52,770	81
Illinois	140	85	14,275	0	55	1	47	92	0	0	343,595	213
Michigan	66	21	12,672	10	35	1	35	30	0	0	156,955	150
Kansas	135	71	27,487	15	49	1	19	111	4	0	445,898	208
Neb., Mo., Iowa	0	0	0	0	0	0	0	0	0	0	0	6
Oklahoma	220	111	31,765	28	§81	8	48	96	68	0	881,891	518
Texas	554	320	96,779	45	189	20	104	188	224	18	2,623,393	1,204
North Texas	125	62	12,671	0	63	18	56	31	20	0	350,701	141
West Central Texas	31	14	2,962	3	14	0	13	17	1	0	88,645	76
West Texas	160	116	59,083	4	40	1	21	67	66	5	784,076	435
Panhandle Texas	33	15	3,465	16	2	0	3	28	2	0	108,701	183
East Texas	21	11	2,806	6	4	0	1	2	18	0	137,403	109
Upper Gulf Coast	71	36	8,094	6	29	0	2	7	50	12	527,035	106
Lower Gulf Coast	64	45	5,791	6	13	0	1	12	51	0	411,243	93
South Texas	39	18	1,735	4	17	1	6	20	12	0	163,313	76
South Central Texas	10	3	172	0	7	0	1	4	4	1	52,274	19
Louisiana	60	30	6,556	3	27	1	5	9	30	15	452,937	192
Northern	20	7	1,347	3	10	1	4	9	6	0	84,565	78
Southern	40	23	5,209	0	17	0	1	0	24	15	368,372	114
Arkansas	20	12	1,231	0	8	0	6	10	4	0	81,523	33
Mississippi	27	16	3,464	0	11	0	1	0	22	4	172,136	75
Ala., Ga., Florida	8	2	140	0	6	0	2	4	2	0	31,465	18
Montana	31	17	1,478	7	7	5	14	11	1	0	65,385	45
Wyoming	15	10	7,374	0	5	0	2	5	8	0	73,624	23
Colorado-Utah	2	2	717	0	0	0	0	0	2	0	12,869	6
New Mexico	30	22	3,466	2	6	2	7	15	6	0	100,080	94
California	196	162	34,941	7	27	9	32	110	42	3	765,759	261
Total May	2,104	1,146	246,061	211	747	69	819	761	415	40	7,202,039	3,930
Total April	2,157	1,151	232,700	224	782	127	792	802	397	39	7,475,100	3,957

*Four weeks ending May 26, 1945. Service wells included: †59, ‡130, §2.

Permian Basin

(Continued from page 150)

to the surface in 1 minute and recovered 22 stands of clean oil and 30 ft. of salty sulfur water. It was drilling below 8,687 ft., still in the Devonian.

WEST TEXAS SUCCESSFUL WILDCATS

Andrews County: Extension to old oil pool—DeKalb Agricultural Assn. 1 Lockhart & Brown, Sec. 15, Blk. A-42, PSL, 1½ mi. NW Mascho pool, elev. 3,246 ft., pumped 131 bbl. day through 2-in. tubing, perf. 4,364-4,540 ft. San Andres, gravity 31.5°, gas-oil ratio 156, PB 4,540 ft., TD 4,595 ft.

Gaines County: Extension to old oil pool—Shell 1 William Pierson, Sec. 452, Blk. G, GCSD&RGNG Sur., 1¼ mi. E Russell pool, elev. 3,536 ft., top pay 7,285, pumped 105 bbl. day through 2½-in. tubing set at 7,687 ft. Clear Fork, gravity 33°, TD 7,727 ft.

Winkler County: New oil pay—Sun 2 Keystone, Sec. 4, Blk. 77, PSL Sur., Keystone pool, elev. 2,979 ft., pumped 63 bbl. day, perf. 8,460-8,594 ft., Silurian, gravity 31.4°, gas-oil ratio 761, Ellenburger 10,337 ft., PB 8,594 ft., TD 10,396 ft.

WEST TEXAS WILDCAT FAILURES

Gaines County: Humble 1 O. L. Bishop, Sec. 45, Blk. H, D&W Sur., 6 mi. SW Cedar Lake pool, elev. 3,162 ft., dry in San Andres, TD 5,187 ft.

Martin County: Richfield 1 Stimson & Burley, Sec. 11, Blk. 38, T-1-S, T&P Sur., 8 mi. NE Midland, elev. 2,794 ft., San Andres 4,405 ft., dry, TD 4,550 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Skelly Oil Co. 2 Johnson, south of the Penrose-Deep field in southeastern Lea County, took a drill-stem test at 3,585-3,676 ft., total depth, showed gas to the surface in 5 minutes and flowed 30 bbl. of 33° gravity oil in 30 minutes. The wildcat is 1 mile south of 2 Steeler which recently failed to make a producer. The Texas Co. 1 Eaves, wildcat 14 miles north of Hobbs, was preparing to run a drill-stem test after encountering a light odor of oil and gas at 8,520-30 ft. Phillips Petroleum Co. 4 Lea-Mex, wildcat northeast of the Maljamar area, was drilling below 12,708 ft. in unreported formation. Stanolind Oil & Gas Co. 1 Jones, wildcat 7½ miles southeast of Hobbs, was drilling below 9,959 ft. in lime and chert.

Continental Oil Co. will drill a 5,200-ft. wildcat in southern Chaves County. It is 1 Federal Unit, 2,310 ft. from the north and west lines of 21-15s-29e, about 20 miles northeast of Artesia and a short distance north of the Eddy County line.

SOUTHEASTERN NEW MEXICO SUCCESSFUL WILDCAT

Lea County: New oil pay—Gulf 1 State-Andrews, 32-22s-38e, Drinkard-Yeso pool, elev. 3,395 ft., flowed 550 bbl. day through 17/64-in. choke on 2-in. tubing, perf. 6,930-7,000 ft. Wichita-Albany, gravity 38.3°, gas-oil ratio 1,371, PB 7,189 ft., TD 7,400 ft.

California Fields

(Continued from page 152)

ductive member. At this record depth the bit was still in formations of Pliocene age and will probably continue in Pliocene for some time to come as this section at Ventura attains great thickness. Various estimates indicate the Pliocene section to be from 15,000 ft. to 20,000 ft. which indicates the top of the Miocene may be beyond the drill at the present time. Additional work is getting under way at Capitan where Shell Oil Co. proved up one new Miocene sand some time ago and found but did not test a second zone. General Petroleum Co. is drilling its first Capitan deep test and Shell is starting two new holes on the Covarrubias lease.

CALIFORNIA WILDCAT FAILURES

Contra Costa County, Lafayette: Shell 1 East Bay, 13-1n-3w, bottomed in hard gray sand, prod. test 6,166-8,408 ft. slight blow, mud and water, TD 8,408 ft., dry.

Kern County, Dominion: Maurer & Bishop 1 Jean, 15-26s-28e, bottomed in basement rocks, all sands barren, Pyramid sand 563 ft., Vedder absent, Walker 783 ft., TD 1,074 ft.

McKittrick: H. H. Magee 5 Tulare, 29-30s-22e, bottomed in gray shale, upper shale carried small oil showing, TD 1,330 ft., dry.

Midway-Sunset: Richfield 1-D Fairfield, 1-31s-22e, bottomed in gray sand, only minor showings, TD 3,195 ft., dry.

Mount Poso: U. S. Drilling 1 Ball, 2-27s-28e, bottomed in basement rocks, top barren Vedder sand 1,060 ft., top granite 1,448 ft., TD 1,449 ft., dry.

Los Angeles County, Pico Canyon: Standard 42 P.C.O., 1-3n-17w, bottomed in fractured gray sand, steep dips, unable to redrill up structure, test not conclusive, TD 8,258 ft., dry.

San Luis Obispo County, Paso Robles: Norris Stamping Co. 1 Dresser, 9-27s-13e, bottomed in tight sand, prod. test 2,110-56 ft., bailed water with trace of oil, TD 2,932 ft., dry.

Santa Barbara County, Elwood: Union 1 Storke, 24-4n-29w, bottomed in gray sand, only minor showings, TD 5,022 ft., dry.

Yolo County, Dunnigan Hills: Texas 14-1 Dunnigan, 12-10n-1w, bottomed in gray water sand, base Capay shale 2,801 ft., form. test 2,802 ft., recovered salt water, TD 4,715 ft., dry.

CALENDAR

October

American Association of Oil Well Drilling Contractors, Oklahoma City, October 1-2.

Texas Mid-Continent Oil and Gas Association, Rice Hotel, Houston, October 4-6.

I.P.A.A., annual membership meeting, Tulsa, October 15, 16 and 17.